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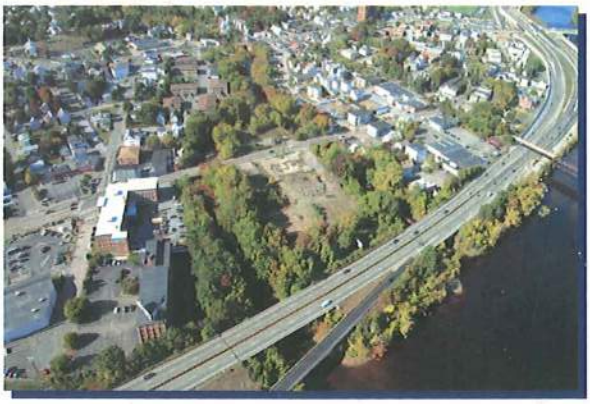
City of Manchester, New Hampshire

Summary Report for Phase I (1999 to 2009) Combined Sewer Overflow Abatement Program

September 2009



Final Report

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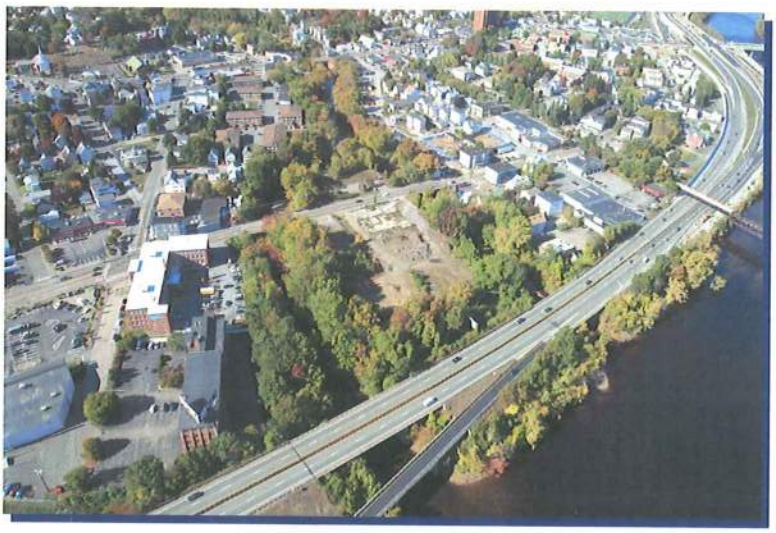
Executive Summary

The city of Manchester, New Hampshire, is nearing completion of the first phase of its multiyear, multimillion dollar combined sewer overflow (CSO) abatement program. Once the city submits its revised Long-Term CSO Control Plan (LTCP) in March 2010 they will have achieved all the original Phase I goals. Moreover, Phase I will have been completed under budget, ahead of schedule, included more system improvements than originally planned, and achieved a higher CSO level of control than expected.



Phase I CSO abatement projects eliminated all CSOs to the Piscataquog River upstream of Bass Island.

Origin of CSO Program

The Federal Clean Water Act (CWA) requires municipalities nationwide to reduce or eliminate CSOs. In 1994 the Environmental Protection Agency (EPA) issued its National CSO Control Policy, mandating each CSO community to develop and implement a LTCP to eliminate or reduce untreated CSO discharges to the nation's waterways.

Manchester, a CSO community, submitted a recommended LTCP for its CSOs to the EPA and the New Hampshire Department of Environmental Services (NHDES) in 1995. Based on this plan, the city and the EPA entered into a Compliance Order (CO) on March 15, 1999, for control of the city's CSO discharges, and thus began Phase I of the program. The city's compliance is administered through its National Pollutant Discharge Elimination System (NPDES) permit for the water pollution control facility (WPCF) and the CSO outfalls throughout the city.

Phase I CSO Abatement

Phase I implemented several projects, primarily on the city's west side, over a ten-year period. It also will reassess appropriate CSO control of the rest of the city. Table ES-1 describes each CO requirement and its status, and Figure ES-1 shows Phase I milestones.

Phase I focused on 16 combined sewer drainage basins. Thirteen were to be fully separated, one was to be partially separated, and two were to have flows further controlled by weir modifications. The city also was required to construct a new secondary treatment wet weather diversion pipe at the WPCF, complete a Supplemental Environmental Projects Program (SEPP), and further evaluate/study the Cemetery Brook drainage basin.

The program's success allowed the city to increase the scope of improvements (and remain under budget) beyond the CO requirements to fully separate two other drainage basins (Poor Street and Lorraine Street), further evaluate three drainage basins (Stark Brook, Pennacook Street and Turner/Ferry Streets), and complete additional piping (rehabilitated and replacement sewers) and surface improvements (catch basins, reconstructed roads, sidewalks, curbing, pedestrian ramps, etc.). Figure ES-2 shows the 15

CSO drainage basins fully separated during Phase I.

Full separation of the 15 CSO drainage basins was accomplished through eight separate contracts. Construction within these basins resulted in 53 miles of new or rehabilitated piping. Table ES-2 summarizes the drain, sewer, water, gas, and surface construction completed. The result was an upgrade to over 25 miles of roads, curbing and sidewalks, while most of the underground pipelines were replaced or rehabilitated.

The positive impact to receiving waters from this full separation was assessed from the results of the Spring 2008 Flow Monitoring Program, which determined that the CSO activation has been reduced from an annual average discharge of about 53.2 million gallons (based on the 1995 LTCP) to 0.2 million gallons (based on results of spring 2008 flow monitoring and modeling). This is more than a 99 percent decrease to CSO discharges on the west side from the program.

In general, the west side is now controlled to about the 2 year peak hour intensity storm event and there is now less than one overflow per year on average. This exceeds the goal of the Phase I program which was to provide a 3 month level of CSO control from the four outfalls remaining on the west side. The goals of Phase I were documented in the City's "CSO Long-Term Control Plan and Phase I Implementation Schedule" report, which was submitted to the EPA and NHDES in January 1999.

In addition to full separation and related activities, Phase I had many other significant impacts. Numerous and lasting environmental, education and health benefits were realized through the SEPP. These include tangible benefits, such as preservation of open space, development of environmental school curricula, and construction of stormwater and erosion controls. Less tangible benefits such as an improved understanding and appreciation of the natural environment and greater communication between city departments and outside organizations was also achieved.

Also, all CSOs to the Piscataquog River upstream of Bass Island have been eliminated, immediately improving the river water quality. Manchester has established a park system along both banks of the river that includes athletic fields and walking trails. Residents use the river and the adjoining park area for recreation and swimming/wading. Recreational uses overall of the river are increasing as the city continues to promote the parks and improve the surface water quality in the area.

Revising the LTCP

For the next step in the CSO abatement program, the CO requires the city to submit a revised LTCP to the EPA and NHDES by March 15, 2010. In addition to complying with the requirements of the Clean Water Act, and state and federal CSO policies, the revised LTCP must include an:

- Evaluation of Phase I projects – which is documented in this report
- Updated alternative analysis for each remaining CSO (seven basins and 15 outfalls)
- Financial impact analysis
- Recommended future CSO abatement plan with a proposed implementation schedule
- In conjunction with the EPA and NHDES, a determination of the appropriateness of a water quality variance, redesignation of receiving water uses, or temporary partial uses of receiving waters

Figure ES-3 shows the seven remaining CSO drainage basins and the 15 remaining CSO outfalls. The remaining combined area from the seven CSO basins is approximately three times the combined area separated during Phase I.

The revised LTCP will also need to include at a minimum the following flow monitoring to comply with Phase I requirements:

- CSO regulator flow monitoring of Bridge Street (NPDES No. 046), Tannery Brook (NPDES No. 043) and Granite Street (NPDES No. 045)
- Interceptor flow monitoring of the Central Interceptor, East Interceptor South, East Interceptor North and Northeast Interceptor

Manchester has hired a consulting engineering firm to assist in evaluating options and developing recommendations for the revised LTCP.

Goals of Future CSO Abatement

In anticipation of future CSO abatement, the city has identified its goals for the revised LTCP, which include:

- Removing brooks from the sewer system to reduce CSO discharges to the Merrimack River while decreasing dry weather sewer flows to the WPCF
- Achieving CSO abatement with passive measures (separation, storage, etc.) versus off-site treatment facilities (i.e. screening and disinfection)
- Incorporating the results of the separate United States Army Corps of Engineers Merrimack River study, which emphasized control of non-point sources and stormwater rather than CSO abatement for improving water quality in the watershed
- Incorporating a stormwater utility as another way of implementing stormwater projects and improving water quality

Summary

Manchester's multiyear, multimillion dollar Phase I CSO abatement program has met and exceeded many of its original goals. As a result of this program, the city has improved its water resources and infrastructure, while enhancing the quality of life for residents. Building on its Phase I success, the city is now looking to the future. With a clear direction laid out, the city can comfortably expect to realize even further improvements to its overall environmental health.

The city has identified goals for the future CSO abatement program, including removing brooks, such as Cemetery Brook pictured above, from the sanitary sewer system.

Item #	Description	Status	Comments
1 and 2	WPCF Bypass Pipe	Complete	Project Completed 8/11/2000
3	Flow Monitoring Plan	Complete	
4	Piscataquog River CSO Abatement Projects		
	Theophile Street (033) - Full Separation	Complete	CSO eliminated 12/21/2000
	Electric Street (032) - Full Separation	Complete	CSO eliminated 11/11/2002
	Varney Street (036) - Full Separation	Complete	CSO eliminated 12/13/2002
	Sullivan Street (034) - Full Separation	Complete	CSO eliminated 11/11/2002
	South Main Street (S) (038) - Full Separation	Complete	CSO eliminated 9/28/2004
	South Main Street (N) (037) - Full Separation	Complete	CSO eliminated 7/27/2005
	Third Street (039) - Full Separation	Complete	CSO regulator will be evaluated during development of revised LTCP
5	Merrimack River CSO Abatement Projects		
	West Hancock Street (013) - Full Separation	Complete	CSO eliminated 9/7/2004
	Victoria Street (030) - Full Separation	Complete	CSO eliminated 10/28/2004
	West Bridge Street (022) - Full Separation	Complete	CSO eliminated 10/21/2005
	Bremer Street (024) - Full Separation	Complete	CSO eliminated 8/15/2007
	Poor Street (009) - Partial Separation	Complete	CSO eliminated 2/19/2008
	Crescent Road (042) - Full Separation	Complete	CSO eliminated 5/14/2008
	Schiller Street (011) - Full Separation	Complete	CSO regulator will be evaluated during development of revised LTCP
6	CSO Weir Modifications		
	Lorraine Street (025) - Raise Weir	Complete	CSO eliminated 7/17/2007
	Turner Street (018) - Raise Weir	Complete	CSO modifications were completed on July 30, 2009
7	Complete Phase 1 within 10 years	Complete	
8	Revisions Clause	N/A	
9	Schedule	Complete	
10 and 11	Further Evaluation/Study of Cemetery Brook	Complete	Final Report submitted 3/2005
12 and 13	Pilot Testing - Swirl Concentrators	N/A	Alternative not preferred
14	LTCP for Phase II	Ongoing	Due in March of 2010
15	SEPP	Complete	Summary Report submitted 12/2006
16	Progress Reports	Ongoing	Continue submitting semi-annual reports
17	Wet Weather Monitoring/Reporting at WPCF	Ongoing	Continue submitting semi-annual reports

Table ES-1

Status of Compliance Order Requirements

Abatement for the Cemetery Brook CSO outfalls will be considered in the revised LTCP

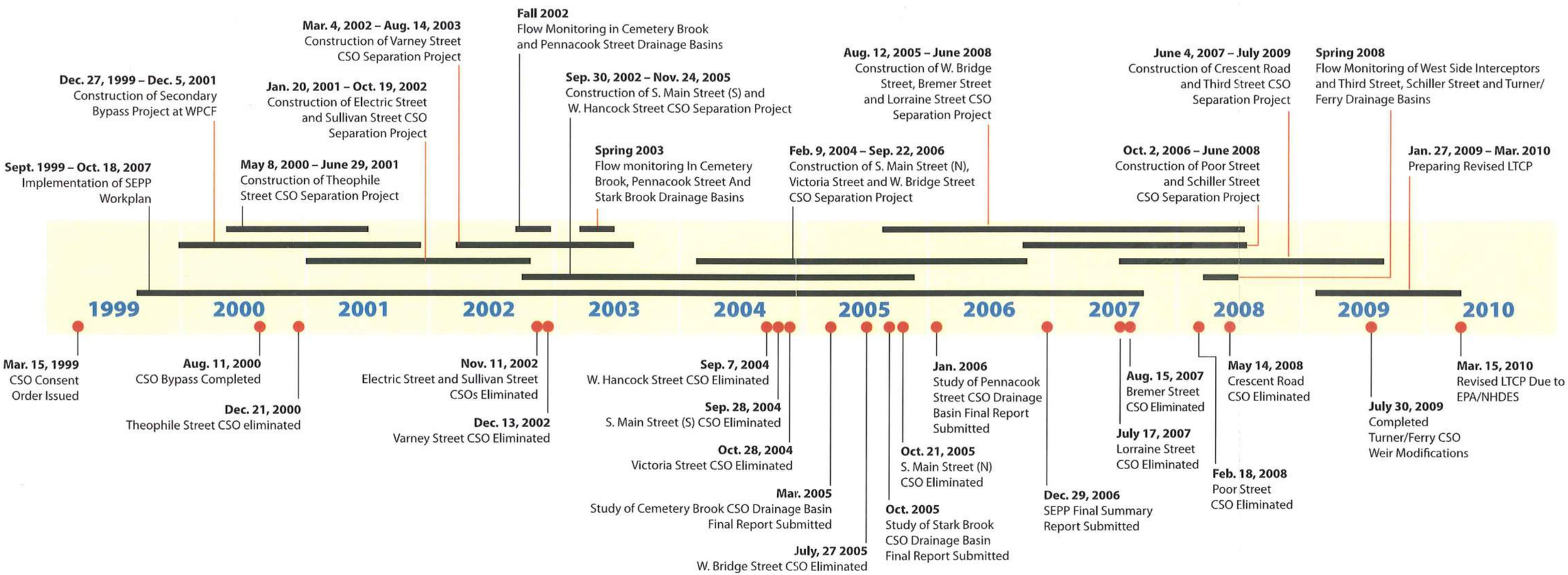
Construction of a forebay at Nutts Pond

New drainage outfall to Piscataquog River off Douglas Street

Full Separation of 15 drainage basins included construction of over 27 miles of new sewer and drains

Phase I eliminated 13 CSO outfalls, including all CSOs to the Piscataquog River upstream of Bass Island

A secondary bypass pipe was constructed at Manchester's WPCF



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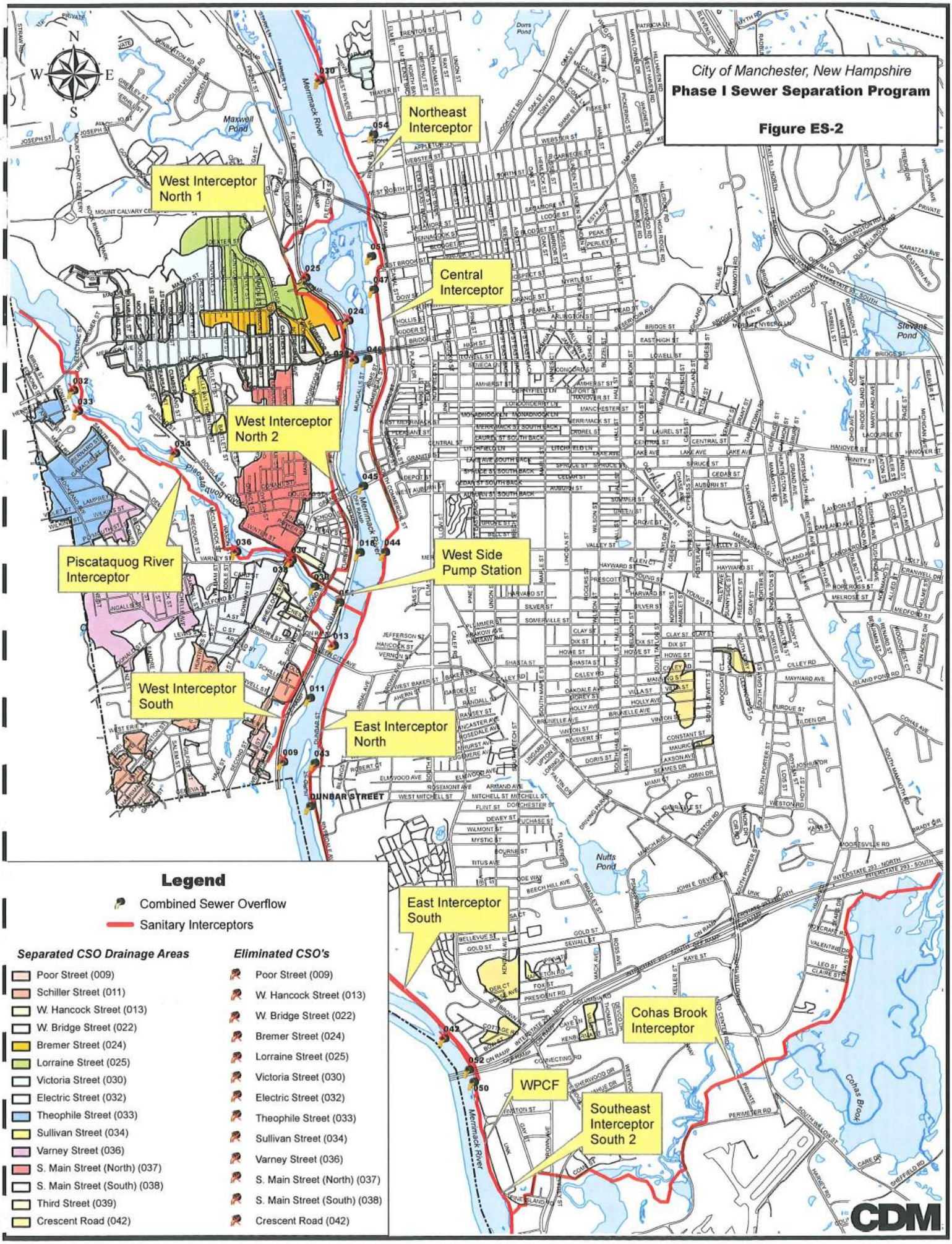
City of Manchester, New Hampshire

Figure ES – 1
Timeline of Select Phase I CSO Control Program Milestones


City of Manchester, New Hampshire
Phase I Sewer Separation Program
Figure ES-2
Northeast Interceptor
West Interceptor North 1
Central Interceptor
West Interceptor North 2
Piscataquog River Interceptor
West Side Pump Station
West Interceptor South
East Interceptor North
East Interceptor South
Cohas Brook Interceptor
WPCF
Southeast Interceptor South 2
Merrimack River
Maxwell Pond
Dorrs Pond
Stevens Pond
Nutts Pond
Cohas Brook
DUNBAR STREET
Legend
Combined Sewer Overflow
Sanitary Interceptors
Separated CSO Drainage Areas
Poor Street (009)
Schiller Street (011)
W. Hancock Street (013)
W. Bridge Street (022)
Bremer Street (024)
Lorraine Street (025)
Victoria Street (030)
Electric Street (032)
Theophile Street (033)
Sullivan Street (034)
Varney Street (036)
S. Main Street (North) (037)
S. Main Street (South) (038)
Third Street (039)
Crescent Road (042)
Eliminated CSO's
Poor Street (009)
W. Hancock Street (013)
W. Bridge Street (022)
Bremer Street (024)
Lorraine Street (025)
Victoria Street (030)
Electric Street (032)
Theophile Street (033)
Sullivan Street (034)
Varney Street (036)
S. Main Street (North) (037)
S. Main Street (South) (038)
Crescent Road (042)
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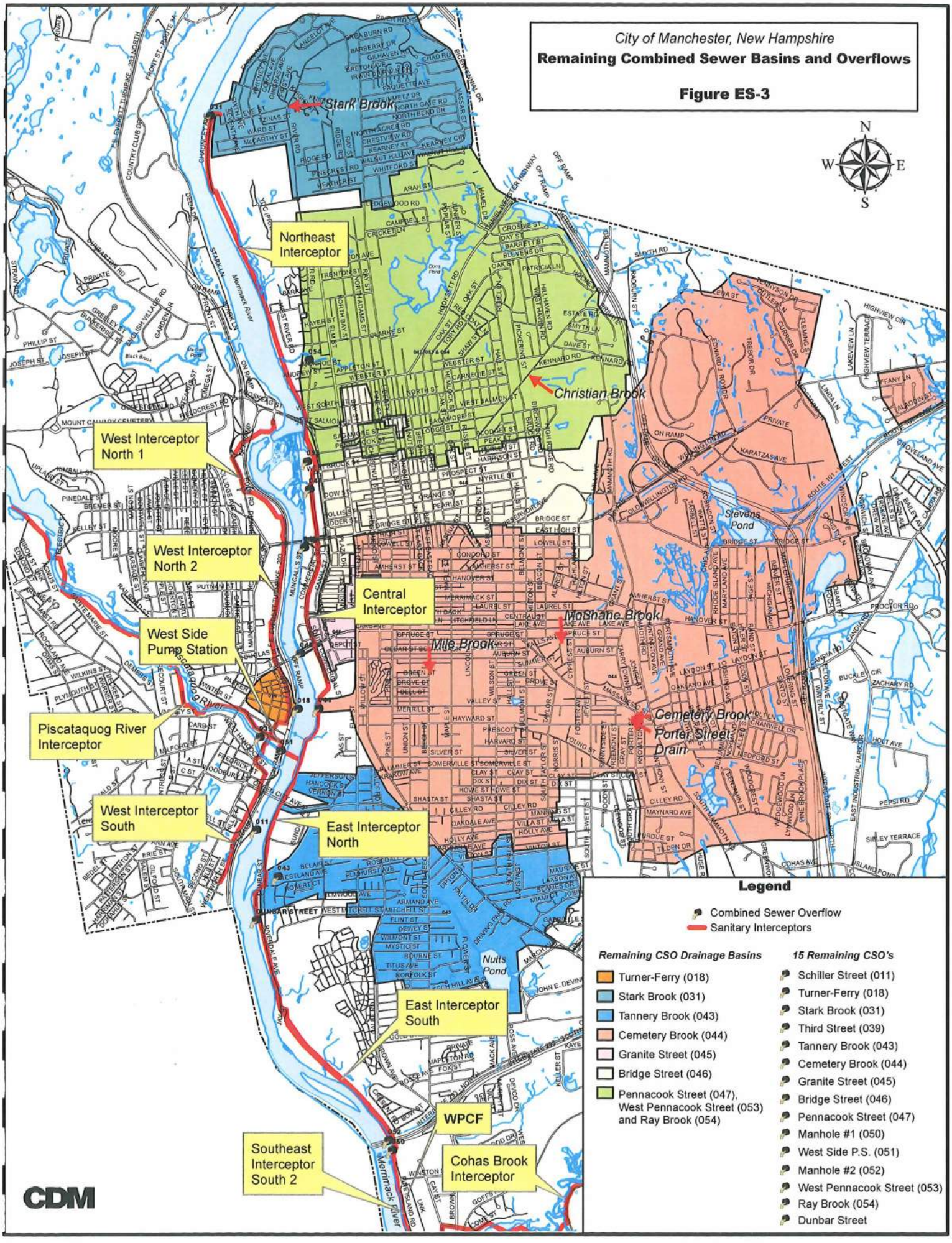
	Construction Contract								
	Theophile Street	Electric Street and Sullivan Street	Varney Street	South Main Street (South) and West Hancock Street	South Main Street (North), Victoria Street and West Bridge Street	West Bridge Street, Bremer Street and Lorraine Street	Poor Street and Schiller Street	Crescent Road	TOTAL
Sewers									
New Sewer (LF)	8,700	7,735	2,245	2,000	5,900	8,380	1,565	5,500	42,025
Rehabilitated Sewer (LF)	0	0	0	4,400	2,170	3,040	1,770	4,625	16,005
New or Rehabilitated SMHs (EA)	67	44	8	35	52	62	8	35	311
New Service Connection (EA)	147	187	38	22	101	94	4	82	675
Private Inflows Removed (EA)	2	31	2	49	23	10	0	4	121
Drains									
New Drain (LF)	4,415	15,200	9,920	19,300	19,150	13,825	11,510	8,835	102,155
New DMHs (EA)	25	101	64	134	144	108	76	54	706
New CBs (EA)	55	142	82	196	229	187	52	66	1,009
New Outfalls (EA)	0	2	1	2	1	0	0	0	6
Other Utilities									
New Gas (LF)	7,365	18,025	10,715	4,420	22,240	8,895	2,120	2,940	76,720
New Water (LF)	1,600	8,310	4,150	3,050	2,950	1,220	105	1,130	22,515
Rehabilitated Water (LF)	0	1,530	0	2,530	10,595	4,640	850	0	20,145
Surface Construction									
Road Reconstructed (Mile)	2.2	4.2	2.6	4.0	4.3	4.2	2.1	2.2	25.8
New or Reset Curbing (LF)	4,830	6,745	4,645	6,310	6,195	7,395	3,135	6,930	46,185
New Sidewalks (LF)	3,100	4,255	2,185	10,090	4,540	5,480	980	3,200	33,830
Pedestrian Ramps (EA)	6	70	13	0	102	76	2	17	286

Table ES-2
Summary of Underground and Surface Construction


City of Manchester, New Hampshire
Remaining Combined Sewer Basins and Overflows
Figure ES-3
N
W
E
S
Northeast Interceptor
West Interceptor North 1
West Interceptor North 2
West Side Pump Station
Piscataquog River Interceptor
West Interceptor South
Central Interceptor
East Interceptor North
East Interceptor South
WPCF
Southeast Interceptor South 2
Cohas Brook Interceptor
Stark Brook
Christian Brook
McShane Brook
Mile Brook
Cemetery Brook
Porter Street Drain
Stevens Pond
Nutts Pond
Merrimack River
Piscataquog River
Legend
Combined Sewer Overflow
Sanitary Interceptors
Remaining CSO Drainage Basins
Turner-Ferry (018)
Stark Brook (031)
Tannery Brook (043)
Cemetery Brook (044)
Granite Street (045)
Bridge Street (046)
Pennacook Street (047), West Pennacook Street (053) and Ray Brook (054)
15 Remaining CSO's
Schiller Street (011)
Turner-Ferry (018)
Stark Brook (031)
Third Street (039)
Tannery Brook (043)
Cemetery Brook (044)
Granite Street (045)
Bridge Street (046)
Pennacook Street (047)
Manhole #1 (050)
West Side P.S. (051)
Manhole #2 (052)
West Pennacook Street (053)
Ray Brook (054)
Dunbar Street
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1 Section One

Section 1
Phase I CSO Abatement Program Overview

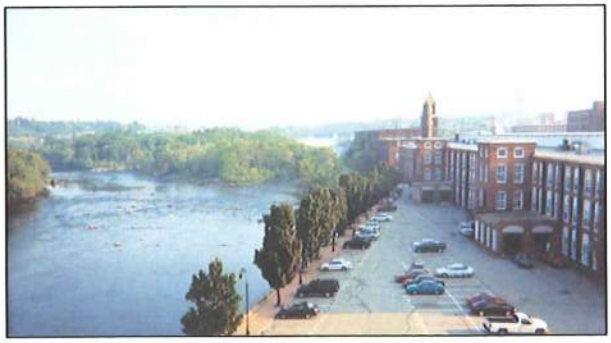
1.1 Background

1.1.1 General

Many older communities in the Northeast and Midwest historically have constructed combined sewer systems, using a single pipe to convey both sanitary wastewater and stormwater to downstream treatment plants. When a combined sewer or interceptor/treatment system exceeds its hydraulic capacity during a rainstorm or snowmelt, the result is a combined sewer overflow (CSO). Consequently, untreated combined wastewater and stormwater flow is discharged to a receiving water.

The Federal Clean Water Act (CWA) requires municipalities nationwide to reduce or eliminate CSOs. In 1994 the Environmental Protection Agency (EPA) issued its National CSO Control Policy, mandating each CSO community to develop and implement a Long-Term CSO Control Plan (LTCP) to eliminate or reduce untreated CSO discharges to the nation's waterways.

The city of Manchester, a CSO community, has been complying with these requirements over the past 10 years. Manchester's compliance is controlled through its National Pollutant Discharge Elimination System (NPDES) permit for the water pollution control facility (WPCF) and the CSO outfalls throughout the city.



The Merrimack River divides the city of Manchester and is generally considered the defining landmark for the former mill city.

1.1.2 Manchester's Long-Term Control Plan

The city submitted a recommended LTCP for its CSOs to the EPA and the New Hampshire Department of Environmental Services (NHDES) in 1995. Based on this plan, the city and the EPA entered into a CSO Compliance Order (CO) on March 15, 1999, for control of the city's CSO discharges. The CO is included in Appendix A.

The negotiated LTCP used a phased approach. Phase I of the CSO abatement program required the implementation of several projects over a ten year period followed by a reassessment of appropriate CSO control. This reassessment (revised LTCP) would be based on the results of Phase I and completed prior to initiating any future activities. The required Phase I projects in the CO included the following:

- Separation of 14 combined sewer basins
- Raising of weirs at two Merrimack River CSOs
- Upgrades to the secondary bypass at the WPCF
- Alternatives assessment study of the Cemetery Brook drainage basin
- Supplemental Environmental Projects Program (SEPP)
- Continuous flow monitoring program
- Submit revised LTCP in March 2010

1.2 Existing Combined Sewer System

1.2.1 General

Prior to beginning Phase I in 1999, the wastewater collection system within Manchester conveyed flow from approximately 90 to 95 percent of the population and about 45 percent (9,800 acres) of the city's total land area. Combined sewers served about 70 percent of the land area in Manchester. Most of the combined portion of the collection system was in the central portion of the city along the Merrimack and Piscataquog rivers. The wastewater collection system consisted of approximately 190 miles of gravity pipe, ranging in size from 4 to 108 inches in diameter, some of which have been in service since the mid 1800s.

Based on the results of flow metering completed in the early 1990s, approximately 960 million gallons (MG) of stormwater and sanitary flow was generated by the combined sewer system in Manchester each year. Roughly 220 MG of the annual flow volume was discharged as untreated CSO to the Merrimack and Piscataquog rivers by the 26 known CSO outfalls at the time of the flow metering. The rest of the wet weather flow (about 77 percent) was captured by the combined sewer system and received treatment and disinfection at the WPCF. Because of the high volume of stormwater and sanitary flow captured by the collection system, surcharging occurred regularly in the city's interceptors and collection pipes upstream of the West Side Pump Station (located on Cleveland Street adjacent to Route 293) and Crescent Road Pump Station (located at the WPCF).

1.2.2 West Side of Manchester

Phase I focused on CSO abatement on the west side of Manchester. Fourteen of the 16 combined sewer basins identified in the CO for full separation, partial separation or weir modifications are on the west side. This focus on the west side was largely due to the constant system surcharging that had caused sewer system backups into residences and businesses. The combined wastewater system was exceeding the capacity of the West Side Pump Station during rain events, thus causing the backups. During certain rain events as much as 30 to 40 feet of surcharge/water pressure was on the pipe.

This surcharging caused a backflow of water from the pump station, resulting in sewer service backups and additional CSO discharges through some CSO regulator interceptor connections (with lower elevation weirs). Significant surcharging also relocated manhole covers, created difficulty with fine adjustments to control the influent gate to the pump station and resulted in additional equipment wear and maintenance due to backwater spraying in the screening/wet well room.

The West Side Pump Station pumps all wastewater flows across the Merrimack River to the east side.

Further, CSO discharges along the Piscataquog River caused the river to exceed New Hampshire Water Quality Standards for bacteria. CSO discharges included floatables (such as paper and plastic products) that diminished river aesthetics. Finally, CSO discharges to the river had bacteria that increased the health risk while swimming, an important factor considering the upstream reaches near athletic fields was often used for wading and swimming.

Thus, during planning for the city's LTCP, an alternatives analysis evaluated reducing the surcharge conditions on the west side, while abating CSOs to address the National CSO Control Policy requirements. The analysis concluded that sewer separation was the most feasible and cost-effective method to address both concerns.

Phase I of the LTCP targeted eliminating CSO discharges to the Piscataquog River.

Sewer separation would eliminate water quality violations due to CSO discharges and reduce aquatic health risk for primary and secondary contact recreation during storm events in the Piscataquog River. It was also anticipated that the river aesthetics would improve, and the fishing habitat would become cleaner as a result of fewer pollutants that previously had been discharged from the CSOs.

1.3 Compliance Order Requirements

The following sections summarize the specific requirements of the city's CO.

1.3.1 Increase Wet Weather Treatment at the WPCF

Paragraphs IV.1 and IV.2 of the CO required the city to design and construct modifications at the WPCF to allow up to 50 million gallons per day (mgd) of wet weather flow to pass through the primary treatment facilities and bypass the secondary treatment facilities. All flow through the WPCF would then receive disinfection. The modifications would ensure reliable treatment of wet weather flow during normal operating conditions (providing a combination of primary only and primary and secondary treatment) up to about 70 to 85 mgd. Section 2 discussed implementation and results of this project.

Modifications were made at the city's WPCF to allow for additional primary treatment of wet weather flows.

1.3.2 Phase I CSO Abatement Projects

Paragraphs IV.3 through IV.8 identified the CSO abatement projects required to be completed during Phase I. The CO requirements for the CSO abatement projects for the identified drainage basins are shown in Table 1-1. Section 3 summarizes the implementation of the CSO abatement projects.

Phase I CSO Drainage Basin (NPDES Outfall #)	Compliance Order Requirements
Piscataquog River Basins	
Theophile Street (033)	Separation
Electric Street (032)	Separation
Sullivan Street (034)	Separation
South Main Street (S) (038)	Separation
Varney Street (036)	Separation
South Main Street (N) (037)	Separation
Third Street (039)	Separation
Merrimack River Basins	
West Bridge Street (022)	Separation
Bremer Street (024)	Separation
Poor Street (009)	Partial Separation
Schiller Street (011)	Separation
Victoria Street (030)	Separation
Crescent Road (042)	Separation
Turner Street (018)	Raise Weir
Lorraine Street (025)	Raise Weir
West Hancock Street (013)	Separation

Table 1-1
Phase I CSO Abatement Projects

To determine the success of the Phase I sewer separation projects, the CO required an interceptor system flow monitoring plan and a proposed implementation schedule. The plan would determine the effectiveness of the program in reducing CSO discharges and further characterize the overflows from the remaining CSOs.

1.3.3 Cemetery Brook Basin Study

Paragraphs IV.10 through IV.13 required further evaluation of the Cemetery Brook drainage basin and a determination if swirl concentrator technologies were feasible for CSO abatement. If the alternative was feasible, the city would conduct pilot testing, including construction, operation and data gathering of a swirl concentrator. After completing the Cemetery Brook CSO abatement evaluation, a Final Report would be submitted to the EPA and NHDES. Section 4 discusses further evaluation of the CSO basins.

1.3.4 Long-Term Control Plan Update

Paragraph IV.14 required the city to submit a revised LTCP for CSO abatement by March 15, 2010, which is 11 years from the CO's date of issuance. The revised plan would evaluate the effectiveness of the Phase I projects in determining the alternatives analysis and proposed abatement of the remaining CSO outfalls. Further, the revised LTCP would include a financial capabilities analysis and an implementation schedule of proposed abatement projects. Future projects should determine the water quality objectives for the Merrimack River watershed, such as consideration of the conclusion of the Merrimack River Coalition Study. Section 7 discusses the requirements of the revised LTCP and the city's preparation for future CSO abatement projects.

1.3.5 Supplemental Environmental Projects Program

Under Paragraph IV.15 the city was required to fund and implement a SEPP that would implement broad-based environmental projects, including land preservation, storm water control, streambank stabilization and erosion control, urban pond restoration and environmental education for children. The city's SEPP program is summarized in Section 5.

1.3.6 Semi-Annual Progress Reports and Work Projections

Paragraph IV.16 required the city to submit semi-annual progress reports to the EPA and NHDES describing the work from the previous six months and that projected for the next six months of each reporting period. These reports are discussed in Section 6.

1.3.7 Wet Weather Monitoring and Reporting Requirements

Paragraph IV.17 required the city to monitor and report on the wet weather treatment events at the WPCF. The reporting includes the city's required monitoring of the NPDES effluent water quality parameters and the total flow treated at the WPCF, including primary only and primary and secondary treatment. The CO reporting to environmental agencies is discussed in Section 6.

1.4 Schedule

All Phase I CSO abatement projects have to be completed by March 15, 2009, which is 10 years from the CO's date of issuance. The city submitted implementation schedules for the Flow Monitoring Program, the Piscataquog River CSO abatement projects and the Merrimack River CSO abatement projects to the EPA and NHDES for approval. The approved schedules were incorporated into the city's CO, per Paragraph IV.9. Figure 1-1 summarizes all dates from the approved schedules of Phase I.

1.5 Budget

The budget for Phase I was agreed upon among the city, EPA and NHDES during LTCP negotiations. The established budget for Phase I was $58 million in 1994 dollars. Table 1-2 shows the established budget for Phase I.

Phase I Projects	Estimated Costs[1]
WPCF Bypass Modifications	$800,000
Piscataquog River Basins	$30,300,000
Theophile Street (033)	
Electric Street (032)	
Sullivan Street (034)	
South Main Street (S) (038)	
Varney Street (036)	
South Main Street (N) (037)	
Third Street (039)	
West Hancock Street (013)	
Merrimack River Basins	$19,000,000
West Bridge Street (022)	
Bremer Street (024)	
Poor Street (009)	
Schiller Street (011)	
Victoria Street (030)	
Crescent Road (042)	
Flow Monitoring	$500,000
Cemetery Brook Basin Evaluation	$1,500,000
SEPP	$5,600,000
Update LTCP	$300,000
TOTAL for Phase I	**$58,000,000**

1. Estimated costs include 35 percent engineering and contingencies (ENR=5438, December 1994)

Table 1-2
Phase I CSO Abatement Program Budget

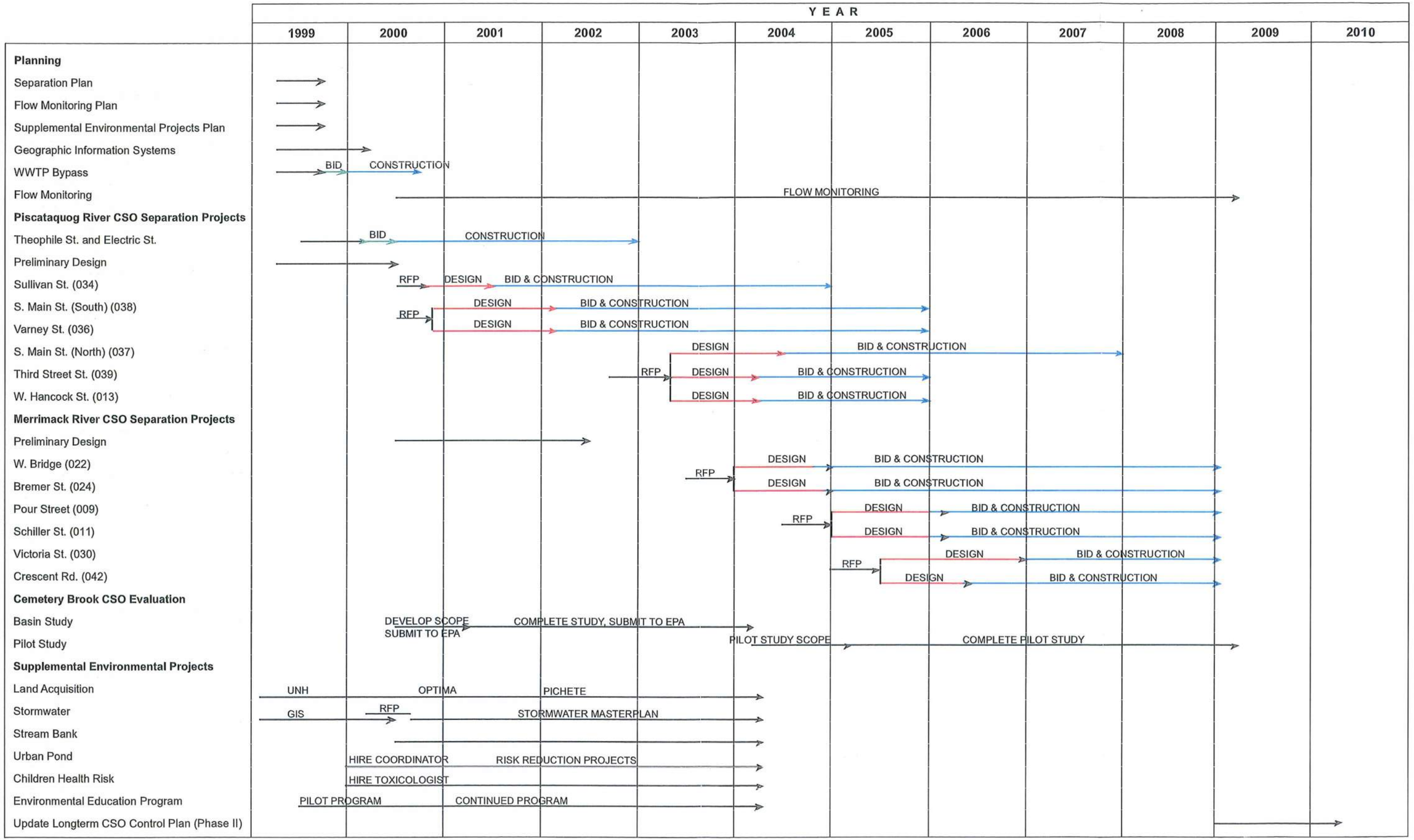


Figure 1-1

Manchester N.H. Phase I CSO –
Long Term Control Plan Implementation Schedule

2 Section Two

Section 2
Increase Wet Weather Treatment Capacity at WPCF

2.1 Background

Paragraphs IV.1 and IV.2 of the CO required the city design and construct modifications at the WPCF to accommodate additional wet weather treatment capacity. The modifications were to allow up to 50 MGD of wet weather flow to bypass the secondary treatment facilities (aeration and final clarification) by constructing a new CSO high flow conduit that received primary treatment only (screening, grit removal and primary sedimentation). All flows would be disinfected. Paragraph IV.17.a of the CO states these WPCF modifications should provide primary treatment "to the practical limit of the primary facilities of 85 MGD under normal operating procedures." Thus, up to 35 MGD would receive secondary treatment.

2.2 Project Implementation

Following issuance of the CO, CDM was tasked with designing a pipe that would allow wet weather primary effluent flow in excess of the secondary treatment capacity to bypass secondary treatment and be routed directly to disinfection. The high flow conduit was designed to carry a flow of 50 MGD given a water surface elevation of 142.5 feet at the primary effluent splitter box. Combined with an assumed secondary treatment capacity of 35 MGD, this was understood to equal the practical limits of the primary facilities.

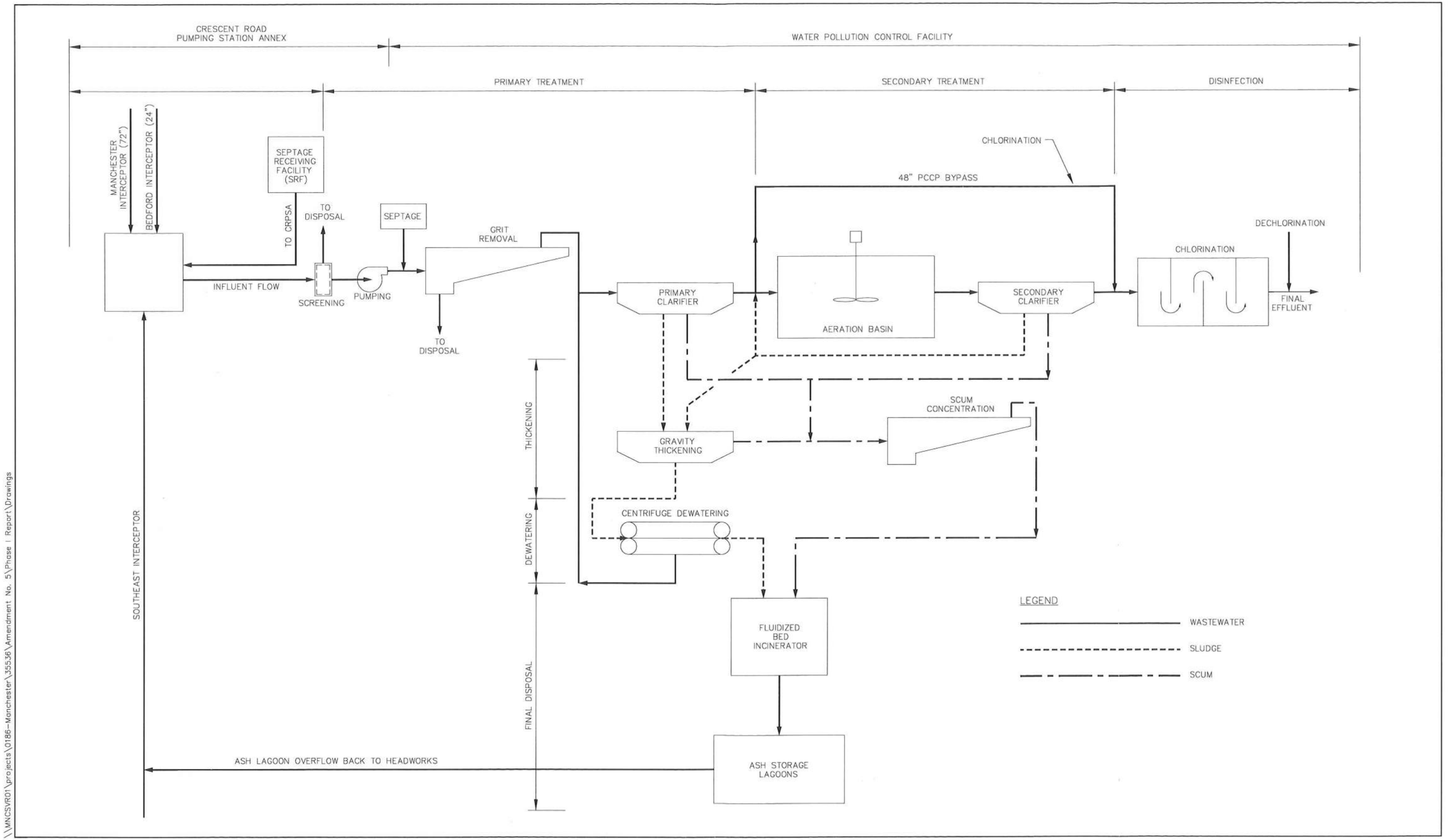
The project was publicly bid and the Notice to Proceed was issued to the construction general contractor, Keymont Construction Inc., with the lowest responsive bid of $838,800 on November 18, 1999 and the contract start date was November 19, 1999.

The primary component of the project was the installation of a 950-foot long 48-inch pre-stressed concrete cylinder pipe (PCCP) high flow conduit. The project also included work at the Crescent Road Pumping Station, grit chambers, primary clarifiers, aeration basins, flow channels, chlorine building and the primary sludge pump area. Figure 2-1 shows a process flow schematic of the WPCF, including the 48-inch pipe. The project's completion date was December 5, 2001 and the final cost for construction was $883,226.75.

The high flow conduit was first operated during a storm in the spring of 2001. During this storm, plant operators observed that the treatment facility operated as expected with two influent pumps running at a plant inflow of about 70 MGD. However, starting up the third pump to increase the influent flow to 85 MGD caused a rapid surge of flow into the primary clarifiers that resulted in submergence of the primary clarifier weirs and scum boxes. This resulted in the overflow of scum into the aeration tanks. Although this was apparently anticipated in the previous upgrade design of the WPCF, it does require additional attention to remove scum from downstream processes.

Testing during subsequent high flow events determined that the high flow conduit had the desired 50 MGD flow capacity at the design splitter box water surface elevation of 142.5-feet, but that the primary clarifier weirs and scum boxes would, in fact, be submerged under these conditions. This is a limitation not in the primary clarifiers themselves, but in the primary effluent piping and channels to and out of the splitter box.

As a result of this problem, CDM recommended several measures that could be taken to accommodate more influent flow without



City of Manchester, New Hampshire
Water Pollution Control Facility

Figure 2-1
Process Flow Schematic

CDM Camp Dresser & McKee Inc.

compromising the primary clarifier facilities, and some of these recommendations have been implemented. The recommendations that were implemented were tested during subsequent wet weather periods.

A bypass pipe was constructed at the WPCF to increase the primary treatment of wet weather flows

2.3 Results

The maximum flow that the plant can handle without the scum box submergence problem is approximately 75 MGD. However, the plant operators found that it was too difficult to control the many operational variables involved (influent pump speeds, aeration tank influent flow control gates, splitter box water surface, etc.) at 75 MGD, and that the maximum influent rate that they were comfortable receiving is about 70 MGD.

Given the hydraulic constraints of the existing primary clarifiers and secondary bypass facilities, the city should consider how to best utilize and/or modify these facilities as part of future CSO abatement programs.

3 Section Three

Section 3
Phase I CSO Abatement Projects

3.1 Background

The city's CO identified the CSO abatement projects required to be completed during Phase I of the LTCP. Within 10 years, 16 combined sewer drainage basins were required to be either fully separated (13 basins), be partially separated (one basin), or have flows further controlled by weir modifications (two basins). The city abated these CSO discharges through the design and construction of eight sewer separation construction contracts. Each contract is discussed below.

Implementation of the city's Phase I CSO abatement projects resulted in nearly 8 miles of new sewer, often replacing old sewer mains in poor condition.

3.2 Theophile Street CSO Separation Project

3.2.1 Background

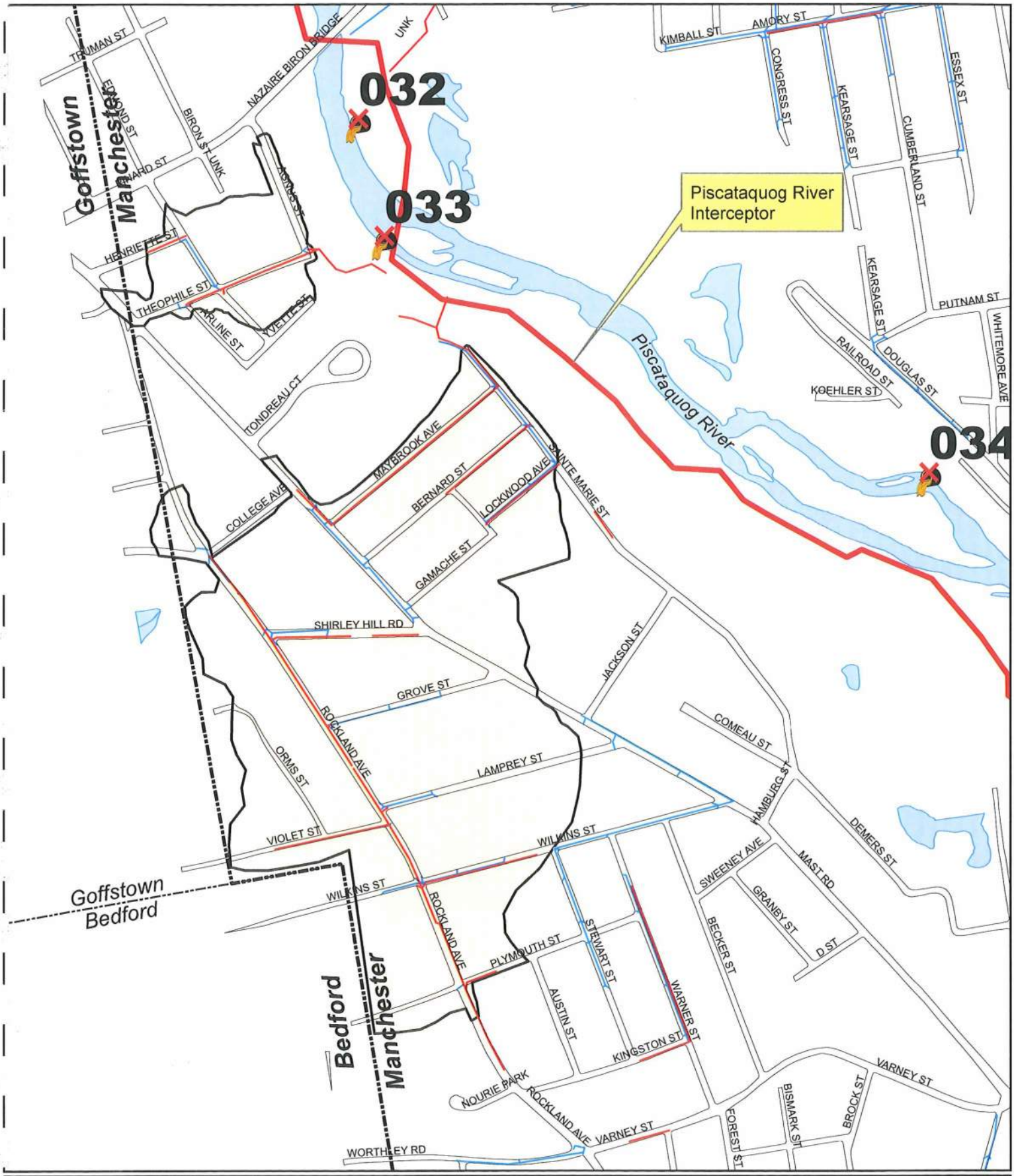
The Theophile Street (033) drainage basin was the first of 14 drainage basins that the CO required to be separated. CDM completed preliminary design of the basin. Work included review of available plans and reports; assessment of drain and sewer systems; evaluation of alternatives; and development of conceptual pipe routes for separating combined sewers. The preliminary design determined that the combined sewered area of the basin was approximately 75 acres, including flow from College Brook.

Preliminary design determined that the 48-inch combined sewer trunk line on Rockland Avenue and the downstream 48-inch outfall to the Piscataquog River were adequately sized for separated stormwater for the 10-year design storm (design storm duration and frequency requirement is detailed in the city's Standard Specifications for Road, Drain and Sewer Construction), and therefore the combined sewer was converted into a drain line. This allowed most of the separation in the drainage basin to be accomplished by installing new sanitary sewers.

3.2.2 Project Implementation

Final design drawings and specifications (Contract Documents) were prepared by CDM and publicly bid on March 24, 2000, with bids received from four pre-qualified contractors. The Notice to Proceed was issued to the construction general contractor, Park Construction Corp., with the lowest responsive bid of $1,958,533.30, on April 28, 2000. The contract start date was May 8, 2000.

Underground utility construction performed by the general contractor for the sewer separation project included installation of 8,700 linear feet (LF) of new sewer pipes, 4,415 LF of new drain pipes and 300 LF of new water pipe. The new sewer and drain pipes installed in the combined sewer drainage basin are shown on Figure 3-1. In addition to and as a result of resolution of utility conflicts, Manchester Water Works (MWW) removed and replaced 1,300 LF of water mains, and Keyspan removed and replaced 7,365 LF of gas mains.



Legend

- Remaining Combined Sewer Overflow
- Eliminated Combined Sewer Overflow
- Sanitary Interceptors
- Previously Combined Area
- New Sewer
- New Drain
- CIPP Lining

CDM

Theophile Street (033) CSO Basin
New Sewer and Drain Pipes

Figure 3-1

Surface work completed as a result of sewer separation included approximately 2.2 miles of road reconstruction, 4,830 LF of new and reset curbing, six new pedestrian ramps and 3,100 LF of new sidewalks.

The CSO NPDES outfall 033 was officially eliminated on December 21, 2000, and the project was completed on June 29, 2001. The final cost for construction was $1,886,355.40. This was $72,198 less than the original bid amount. Most of the separated stormwater flow and the flow from College Brook currently discharge from the now separated 48-inch outfall located in the cross country area at the end of Theophile Street.

3.2.3 Results

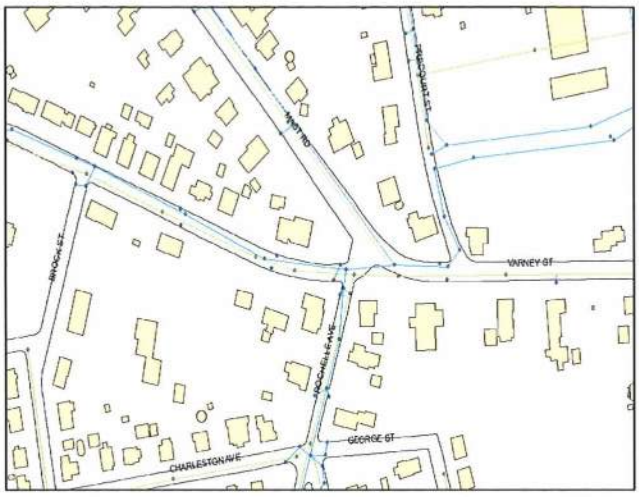
The sewer separation project resulted in more than 4.5 miles of new drain, sewer, water and gas pipes within the 75-acre drainage basin. Further, College Brook was separated from the sewer system and therefore the WPCF no longer treats this source of dry weather inflow.

Elimination of the Theophile Street CSO outfall immediately benefited water quality by reducing CSO impacts in the upper reaches of the Piscataquog River, where the highest potential exists for recreational and contact river uses. Separation reduced about 2.2 MG of untreated CSO discharge to the Piscataquog River annually. All estimated reductions in this section are based on the 1995 LTCP.

3.3 Electric Street and Sullivan Street CSO Separation Project

3.3.1 Background

CDM completed the preliminary design for the Electric Street (032) drainage basin. Work included review of available plans and reports; assessment of drain and sewer systems; evaluation of alternatives; and development of conceptual pipe routes for separating combined sewers. Preliminary design determined that the combined sewered area of the basin was approximately 96 acres.



While completing preliminary designs for the 16 CSO drainage basins separated in Phase I, CDM used the city's GIS to evaluate the existing system.

It also determined that the 48-inch drain line running parallel to Kelley Street west to its outfall on the Piscataquog River was not adequately sized for additional flow from the separation of the combined area. Also, most of the existing combined sewer pipelines were not sufficiently sized to convey stormwater flow from the 10-year design storm. To separate the basin, a new additional 48-inch drainage outfall and new drain pipes were constructed, and the combined system was converted to a sanitary sewer. Sewer mains found in poor condition from the closed circuit television (CCTV) inspection were also replaced with new sewers.

A preliminary design report for the Sullivan Street (034) CSO drainage basin was completed by CDM. Preliminary design determined that nearly 90 percent of the drainage basin was already separated, and the total combined sewer area was only about 17 acres. Most of the drainage from the combined system was redirected to the 42-inch drain on Douglas Street that discharges to the Piscataquog River. A new 12-inch drainage outfall was required to separate Bartlett Street. Because of the small combined sewered area and its location adjacent to the Electric Street drainage basin, separation of this basin was added to this CSO separation project.

3.3.2 Project Implementation

Final design Contract Documents of the Electric Street and Sullivan Street CSO separation project were prepared by CDM and publicly bid on November 15, 2000, with bids received from two pre-qualified contractors. The Notice to Proceed was issued to R.D. Edmunds & Sons, Inc., with the lowest responsive bid of $3,914,512, on January 10, 2001. The contract start date was January 20, 2001.

Underground utility construction by the general contractor for the sewer separation project included installation of 7,735 LF of new sewer pipes, 15,200 LF of new drain pipes and 1,950 LF of new water pipe. The new sewer and drain pipes installed in the combined sewer drainage basin are shown on Figure 3-2. In addition to and as a result of resolution of utility conflicts, MWW removed and replaced 6,360 LF of water mains and rehabilitated 1,530 LF of existing water mains; Keyspan removed and replaced 18,025 LF of gas mains.

Surface work resulting from sewer separation included approximately 4.2 miles of road reconstruction, 6,745 LF of new and reset curbing, 70 new pedestrian ramps and 4,255 LF of new sidewalks.

Phase I surface reconstruction of major intersections was enhanced with installation of 290 pedestrian ramps with tactile warning strips.

In the Electric Street drainage basin, the 48-inch CSO outfall was converted to a drainage outfall, and a new, additional adjacent 48-inch drainage outfall was installed. Both outfalls are required for stormwater flow generated by the area. In the Sullivan Street drainage basin, the 42-inch CSO outfall was converted to a drainage outfall, and a new 12-inch drainage outfall was added at the end of Bartlett Street.

The CSO NPDES outfalls 032 and 034 were officially eliminated on November 11, 2002, and the project was completed on October 19, 2002. The final cost for construction was $4,193,436.47. The final cost was higher than the award of the contract because the city added separation work by change orders on Mason, Bremer and Electric streets.

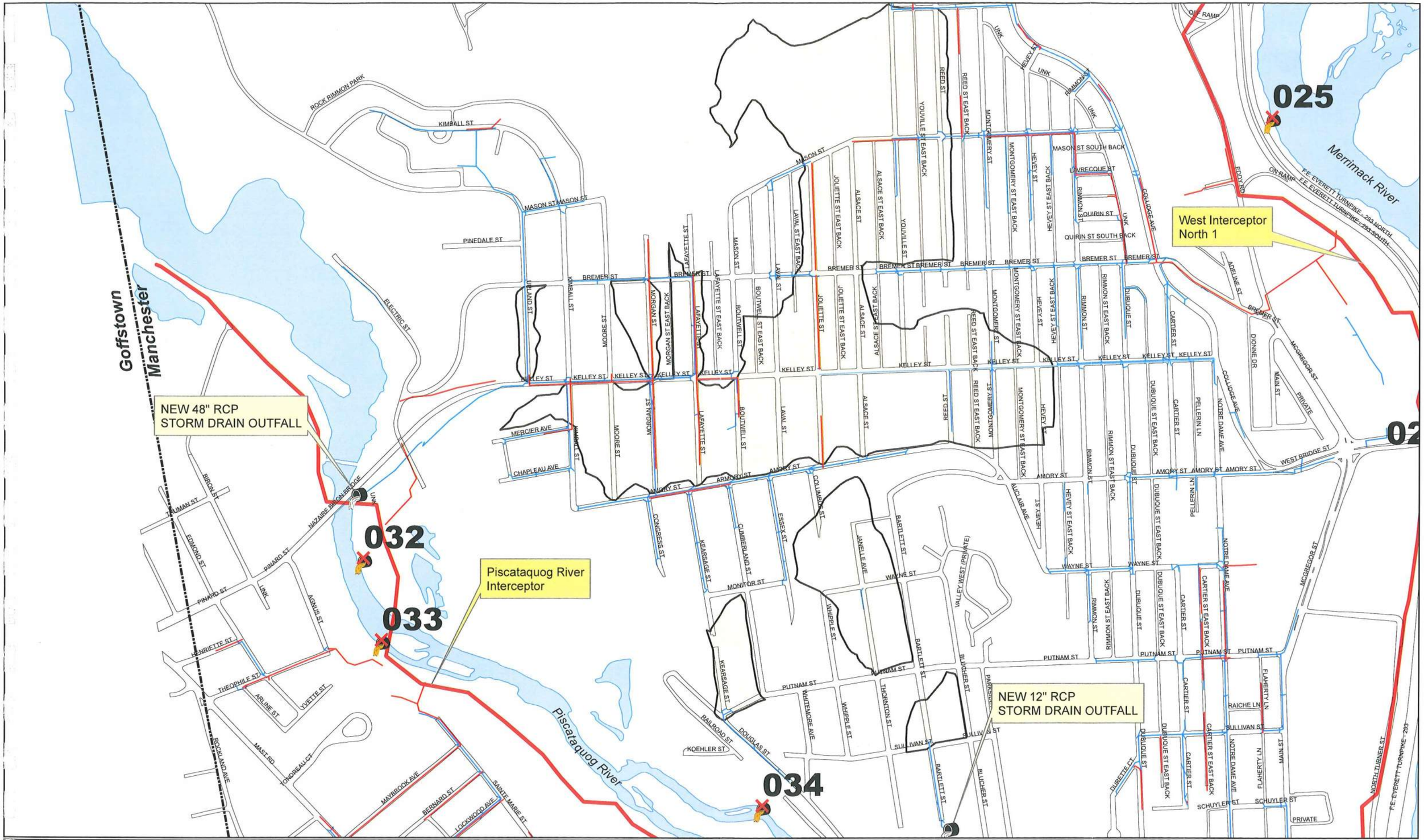
3.3.3 Results

Sewer separation resulted in more than 9.5 miles of new or rehabilitated drain, sewer, water and gas pipes within the two drainage basins. Elimination of the CSO from the Electric Street and Sullivan Street drainage basins reduced about 2.1 MG of untreated CSO discharge to the Piscataquog River annually.

3.4 Varney Street CSO Separation Project

3.4.1 Background

A preliminary design report for the Varney Street (036) CSO drainage basin was completed by CDM in December 2000. The drainage basin is approximately 235 acres, of which roughly 109 acres had been served by a combined sewer system. Based on the preliminary design analysis, CDM determined that most of the combined sewer pipelines were not sufficiently sized to convey stormwater from the 10-year design storm. To separate the basin, new storm drains were constructed, and the combined system was converted to a sanitary sewer.



Legend

- Remaining Combined Sewer Overflow
- Eliminated Combined Sewer Overflow
- Sanitary Interceptors
- Previously Combined Area
- New Sewer
- New Drain
- CIPP Lining

CDM

Electric Street (032) & Sullivan Street (034) CSO Basins
New Sewer and Drain Pipes

Figure 3-2

3.4.2 Project Implementation

Final design Contract Documents were prepared by CDM and publicly bid on December 4, 2001, with bids received from four pre-qualified contractors. The Notice to Proceed was issued to Park Construction Corp., with the lowest responsive bid of $2,343,645.18, on February 21, 2002. The contract start date was March 4, 2002.

Underground utility construction by the general contractor for the sewer separation project included installation of 2,245 LF of new sewer pipes, 9,920 LF of new drain pipes and 525 LF of new water pipe. The new and rehabilitated sewer and drain pipes installed in the combined sewer drainage basin are shown on Figure 3-3. In addition to and as a result of resolution to utility conflicts, MWW removed and replaced 3,625 LF of water mains, and Keyspan removed and replaced 10,715 LF of gas mains.

Surface work resulting from the sewer separation project included approximately 2.6 miles of road reconstruction, 4,645 LF of new and reset curbing, 13 new pedestrian ramps and 2,185 LF of new sidewalks.

The existing CSO outfall was removed and replaced by a new 60-inch outfall, which conveys most of the separated stormwater from the drainage basin to the Piscataquog River.

The CSO NPDES outfall 036 was officially eliminated on December 13, 2002, and the project was completed on August 14, 2003. The final cost for construction was $2,207,364.14, which was $136,281 less than the original bid amount.

3.4.3 Results

Sewer separation resulted in more than 5 miles of new or rehabilitated drain, sewer, water and gas pipes within the 235-acre drainage basin. Elimination of the CSO from the basin reduced about 4 MG of untreated CSO discharge to the Piscataquog River annually.

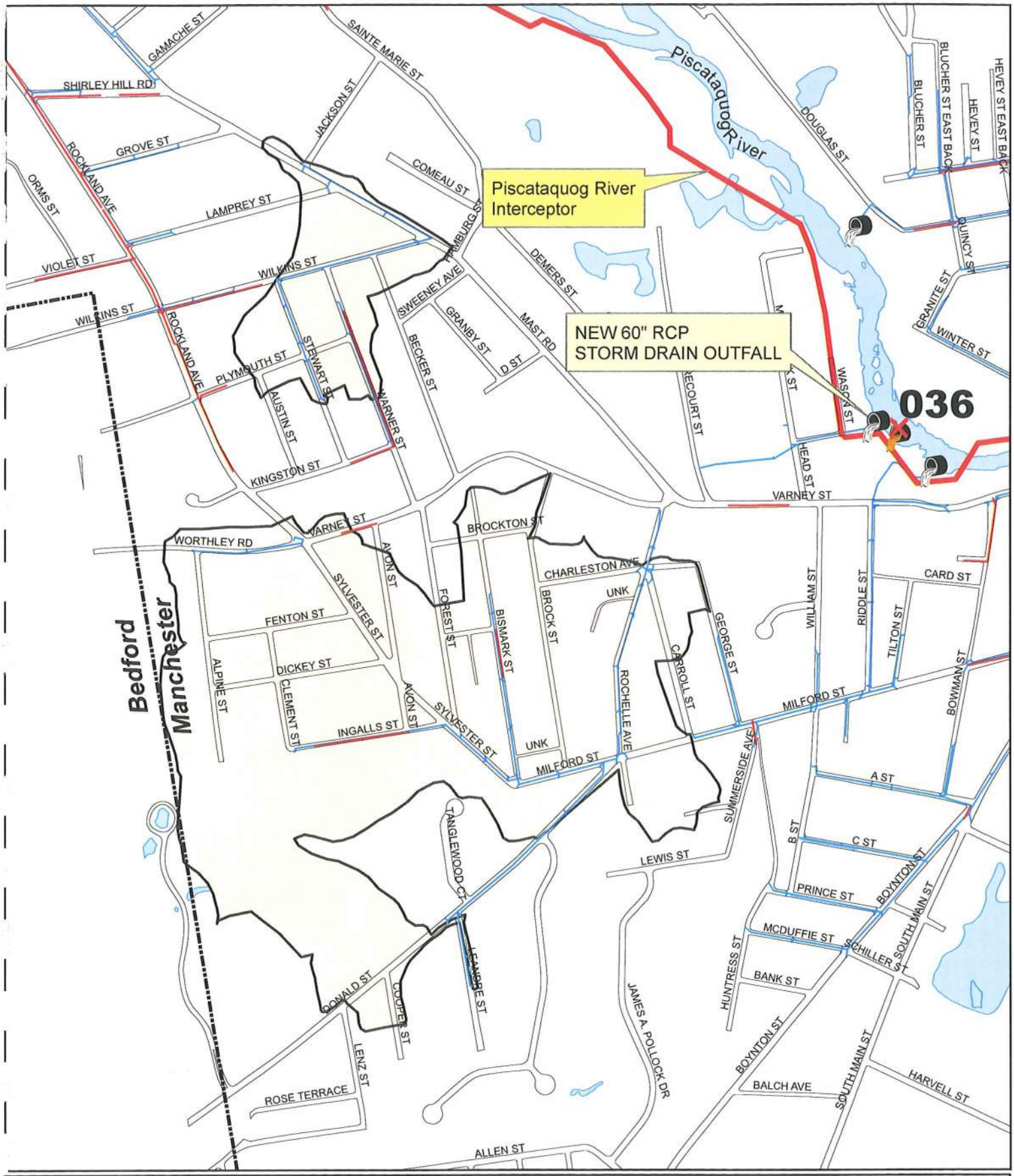
Phase I surface reconstruction included installation of more than 6 miles of new sidewalks and 8 miles of new and reset curbing, including the sidewalk and granite curb installed on Jolliette Street for safe pedestrian traffic to the Northwest Elementary School.

3.5 South Main Street (South) and West Hancock Street CSO Separation Project

3.5.1 Background

A preliminary design report for the South Main Street (South) (038) and West Hancock Street (013) CSO drainage basins was completed by CDM in December 2000. The drainage basins are adjacent to each other and located on the west side of Manchester, but the West Hancock CSO basin discharges to the Merrimack River while the South Main Street (South) basin discharges to the Piscataquog River. The West Hancock drainage basin has a total area of approximately 20 acres, of which approximately seven acres were served by the combined sewer system. The South Main Street (south) drainage basin has a total area of approximately 75 acres, of which approximately 66 acres were served by the combined sewer system.

Based on the preliminary design analysis, CDM determined that most of the combined sewer pipelines were not sufficiently sized to convey stormwater flow from the 10-year design storm in either drainage basin. Therefore, to separate



Varney Street (036) CSO Basin
New Sewer and Drain Pipes

Figure 3-3

the basins, new storm drains were needed and the combined system would be converted to a sanitary sewer. Sanitary sewers found in poor condition based on review of CCTV inspections were replaced with new sewers. The preliminary design report recommended that the sewer separation required for both drainage basins be combined into one construction contract.

3.5.2 Project Implementation

The final design Contract Documents were prepared by Hoyle, Tanner and Associates, Inc. (HTA) and were publicly bid on August 5, 2002, with bids received from three pre-qualified contractors. The Notice to Proceed was issued to the construction general contractor, Park Construction Corp., with the lowest responsive bid of $4,704,455.00, on September 18, 2002. The contract start date was September 30, 2002.

Underground utility construction by the general contractor for sewer separation included installation of 2,000 LF of new sewer pipes, rehabilitation of 4,400 LF of existing sewer pipes, 19,300 LF of new drain pipes and 1,900 LF of new water pipe. The new and rehabilitated sewer and drain pipes installed in the combined sewer drainage basin are shown on Figure 3-4. In addition to and as a result of resolution of utility conflicts, MWW removed and replaced 1,150 LF of water mains and rehabilitated 2,530 LF of water mains; Keyspan removed and replaced 4,420 LF of gas mains.

Surface work completed as a result of sewer separation included approximately four miles of road reconstruction, 6,310 LF of new and reset curbing, and 10,090 LF of new sidewalks.

The 24 and 8-inch South Main Street (South) overflow pipes, located in the Varney Street and South Main Street intersection and discharged out the existing outfall, were abandoned. The combined sewer outfall was converted to a drainage outfall, and a new 36-inch drainage outfall was installed from Log Street to the Piscataquog River.

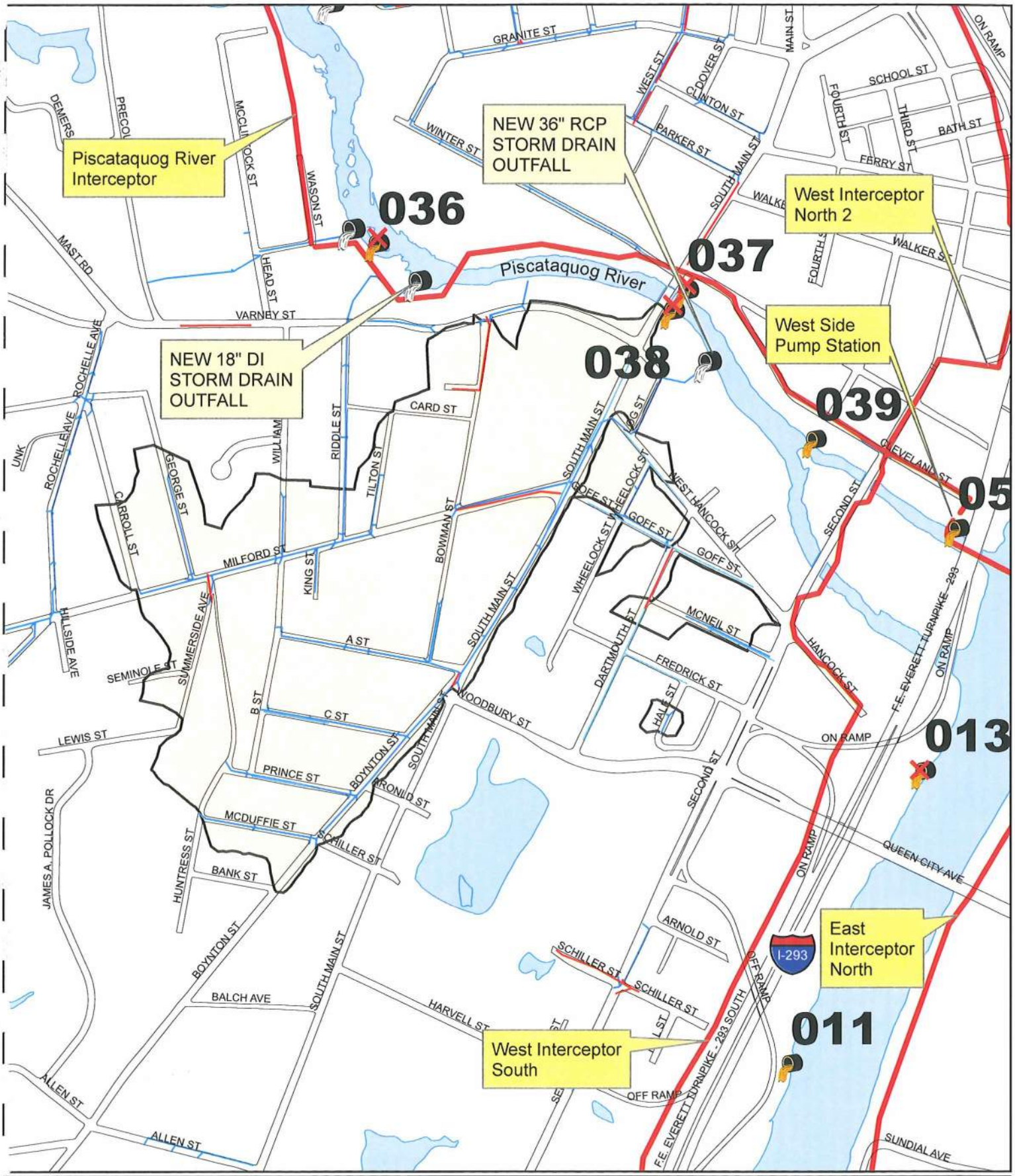
The 15-inch West Hancock Street overflow pipe, located in the Goffe Street and West Hancock Street intersection and discharged out the existing 013 outfall, was abandoned. The combined sewer outfall was converted to a drainage outfall.

The CSO NPDES outfalls 038 and 013 were officially eliminated on September 28, 2004, and September 7, 2004, respectively, and the project was completed on November 24, 2005. The final cost for construction was $4,514,019.47. This was $190,436 less than the original bid amount.

3.5.3 Results

Sewer separation resulted in nearly seven miles of new or rehabilitated drain, sewer, water and gas pipes within the two drainage basins totaling 95 acres. CSO elimination from the South Main Street (South) and West Hancock Street drainage basins reduced about 13.8 MG of untreated CSO discharge to the Piscataquog and Merrimack rivers annually.

Separation of the Phase I CSO drainage basins required installation of more than 19 miles of new drains.



Legend

- Remaining Combined Sewer Overflow
- Eliminated Combined Sewer Overflow
- Sanitary Interceptors
- Previously Combined Area
- New Sewer
- New Drain
- CIPP Lining

CDM

S. Main Street (South) (038) and W. Hancock Street (013) CSO Basins New Sewer and Drain Pipes

Figure 3-4

3.6 South Main Street (North), Victoria Street and West Bridge Street CSO Separation Project

3.6.1 Background

A preliminary design report for the South Main Street (North) (037) and Third Street (039) CSO drainage basins was completed by CDM in December 2000. The drainage basins are adjacent to each other along the Piscataquog River. The South Main Street (North) drainage basin has a total area of approximately 160 acres, of which approximately 113 acres were served by the combined sewer system; five acres of the 12-acre Third Street drainage basin were served by a combined system.

Although not required by the Consent Order, 3 miles of sewer mains were rehabilitated as part of the CSO separation projects to extend their useful life.

Based on the preliminary design analysis, CDM determined that the combined trunk sewer on South Main Street from Parker Street to Blaine Street was adequately sized to convey stormwater flow from the 10-year design storm. At this location, a new sanitary sewer was installed parallel to the existing drain (this work was included in the South Main Street (South) project). The rest of the combined sewer pipelines were not sufficiently sized to convey the design storm in either drainage basin. To separate the rest of the basin, new storm drains were required, and the combined system was converted to a sanitary sewer. Sanitary sewers found in poor condition based on review of CCTV inspections were replaced or rehabilitated as necessary.

A change order was proposed to include the Third Street CSO drainage basin separation work with the South Main Street (North) construction contract. However, differing field conditions resulted in re-design separation of the area. This work was then added to the Crescent Road sewer separation project.

A preliminary design report for the Victoria Street (030) CSO drainage basin was completed by CDM in July 2002. The drainage basin has a total area of approximately 40 acres, of which about eight acres were served by the combined sewer system. Separation of the small area, which previously discharged CSO to the Merrimack River, required new storm drains on Victoria Street, Riverview Place and Davis Street, and the combined sewer system was converted to a sanitary sewer. CCTV inspections found the sewer main on Riverview Place to be in poor condition, and it was replaced with a new sewer pipe. Because of the small combined sewered area the work was included in the South Main Street (North) CSO separation project.

A preliminary design report for the West Bridge Street (022) drainage basin was completed by CDM in March 2003, and is discussed in Section 3.7. Part of the proposed separation on the southern end of the drainage basin was added to the South Main Street (North) project. This was required because of the two interconnections between the two adjacent drainage basins. As a result, separation of Amory Street and the intersecting side streets was added to the contract to prevent combined sewer flows from

entering into the separated South Main Street (North) drainage basin.

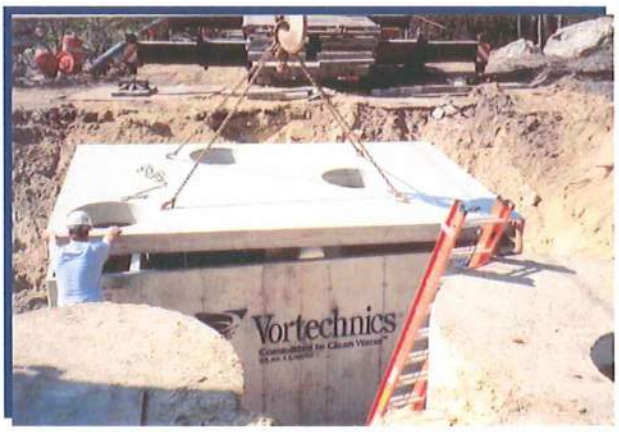
3.6.2 Project Implementation

The final design Contract Documents were prepared by CDM and publicly bid on October 17, 2003, with bids received from three pre-qualified contractors. The Notice to Proceed was issued to Park Construction Corp., with the lowest responsive bid of $4,865,767.60, on January 30, 2004. The contract start date was February 9, 2004.

Underground utility construction by the general contractor for sewer separation included installation of 5,900 LF of new sewer pipes, rehabilitation of 2,170 LF of existing sewer pipes, 19,150 LF of new drain pipes and 2,150 LF of new water pipe. The new and rehabilitated sewer and drain pipes installed in the combined sewer drainage basin are shown on Figure 3-5. In addition to and as a result of resolution of utility conflicts, MWW removed and replaced 800 LF of water mains and rehabilitated 10,595 LF of existing water mains; Keyspan removed and replaced 22,240 LF of gas mains.

Surface work completed as a result of sewer separation included approximately 4.3 miles of road reconstruction, 6,195 LF of new and reset curbing, 102 new pedestrian ramps and 4,540 LF of new sidewalks.

The South Main Street CSO outfall was converted to a drainage outfall, and a new 30-inch drainage outfall was constructed off Douglas Street to separate the rest of the drainage basin. Both drainage outfalls discharge to the Piscataquog River. Although not required by the CO, the city installed a Vortechnic stormwater treatment unit on Douglas Street upstream of the new 30-inch outfall toas a "pilot" project to evaluate the removal of floatables, oil and grease from the stormwater discharge.



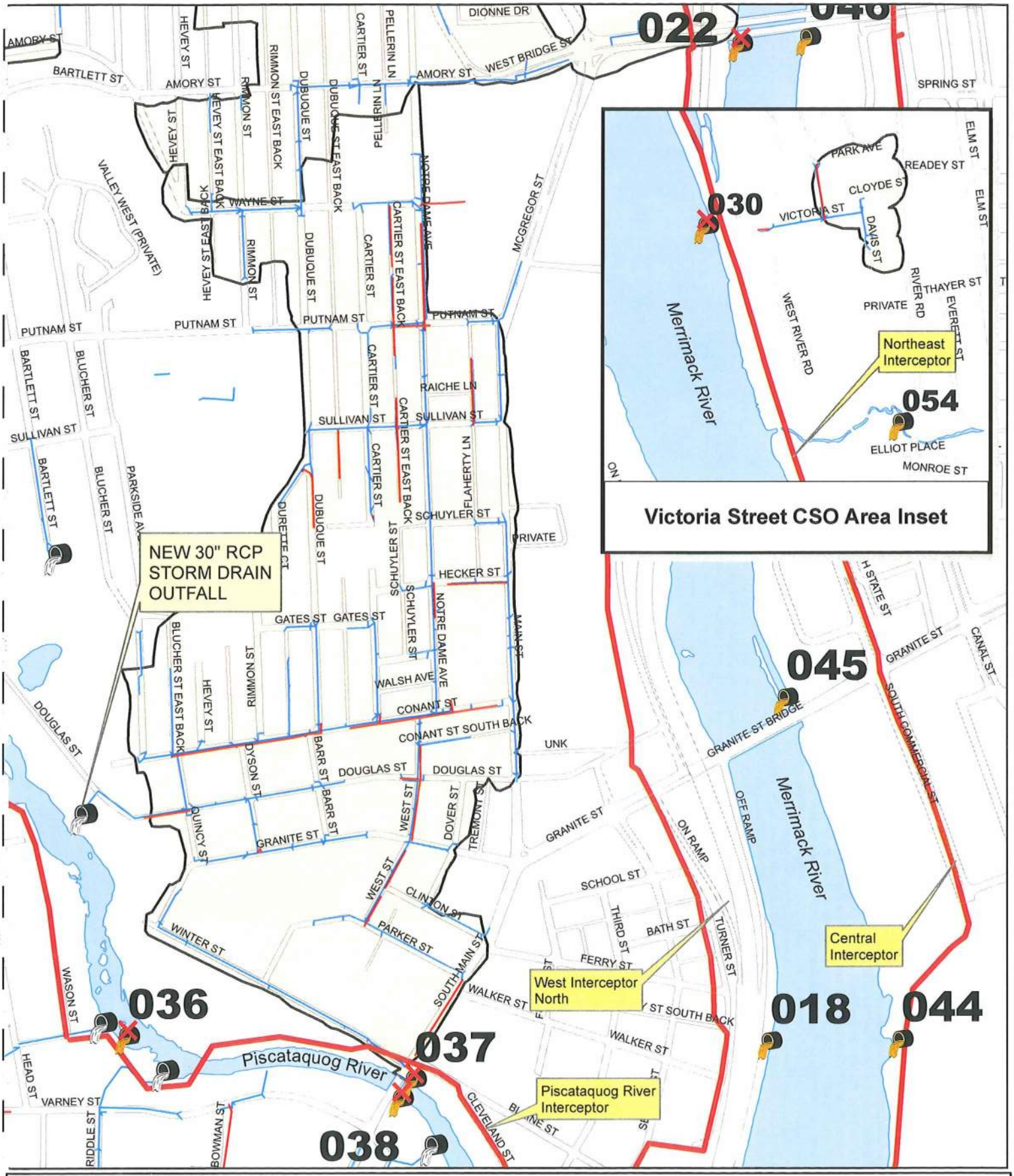
Although not required by the CO, Manchester EPD provided initiative for a stormwater treatment unit which was installed on Douglas Street upstream of the new drainage outfall to remove floatables, oil and grease from stormwater prior to discharging to the Piscataquog River

The 15-inch CSO outfall from the Victoria Street drainage basin was converted to a stormwater outfall. Drainage from part of the West Bridge Street drainage basin separated as part of this project discharges out the former CSO outfall, which is now a stormwater outfall to the Merrimack River.

The CSO NPDES outfalls 030, 022 and 037 were officially eliminated on October 28, 2004, October 21, 2005, and July 27, 2005, respectively. The project was completed on September 22, 2006, and the final cost for construction was $5,678,025.50. The final cost was higher than the award of the contract primarily because additional work was added by the city on Porter Street, Dubuque Back Alley East, Douglas Street, Amory Street, Gates Street, Conant Street and Riverview Place. Also, sewer rehabilitation work was added on Granite Street and Barr Street.

3.6.3 Results

Sewer separation resulted in 12 miles of new or rehabilitated drain, sewer, water and gas pipes within the three drainage basins. Elimination of the CSOs from the South Main Street (North), Victoria Street and West Bridge Street drainage basins reduced about 20.8 MG of untreated CSO discharge to the Piscataquog and Merrimack rivers annually.



Legend

- Remaining Combined Sewer Overflow
- Eliminated Combined Sewer Overflow
- Sanitary Interceptors
- Previously Combined Area
- New Sewer
- New Drain
- CIPP Lining

CDM

S. Main Street (North) (037), W. Bridge Street (022) and Victoria Street (030) CSO Basins New Sewer and Drain Pipes

Figure 3-5

3.7 West Bridge Street, Bremer Street and Lorraine Street CSO Separation Project

3.7.1 Background

A preliminary report for the Lorraine Street (025), Bremer Street (024) and West Bridge Street (022) CSO drainage basins was completed by CDM in March 2003. All three drainage basins are adjacent to each other along the Merrimack River, to which the CSOs discharged. The West Bridge Street, Bremer Street and Lorraine Street drainage basins have a total area of approximately 128, 36 and 98 acres, respectively, of which approximately 128, 36 and 72 acres, respectively, were served by a combined sewer system.

The CO required weir modifications to reduce the frequency of CSO discharges from the Lorraine Street drainage basin. Field investigations completed during initial stages of the preliminary design for the Bremer Street and West Bridge Street drainage basins indicated that the adjacent Lorraine Street drainage basin was interconnected at several locations. In addition, city staff reported flooding problems in the Lorraine Street drainage area. Accordingly, it was determined sewer separation of the Lorraine Street CSO drainage basin should be considered in the preliminary design to further reduce CSO discharges.

Part of the West Bridge Street drainage basin was separated in the South Main Street (North) project. New drainage pipes were put in on Amory and adjacent streets, connecting to existing drainage on West Bridge Street and discharging to the Merrimack River from the former CSO outfall.

Separation of the rest of the West Bridge Street drainage basin and the Bremer Street and Lorraine Street drainage basins required new storm drains and conversion of the combined sewer pipes to sanitary sewers. The new stormwater pipes from the northern end of the West Bridge Street drainage basin and the entire Bremer Street drainage basin were connected to the combined sewer on Bremer Street just east of Coolidge Avenue. The combined sewer pipe from this point to the outfall on the Merrimack River was converted to a drainage pipe. Similarly, the Lorraine Street drainage basin was separated, with the new drainage connecting to the previously combined sewer pipe on Lorraine Street. The combined sewer pipe was converted to a drain pipe and discharges to the Merrimack River from the existing outfall. In both cases, new sewers were installed to redirect sewer services to the West Interceptor North from the converted combined sewer pipe. Sanitary sewers that were either beneath buildings or found in poor condition based on CCTV inspections were replaced or rehabilitated as necessary.

Nearly 26 miles of streets excavated to install the new pipes required by the separation projects were completely reconstructed

3.7.2 Project Implementation

Final design Contract Documents were prepared by CDM and publicly bid on May 20, 2005, with bids received from two pre-qualified contractors. The Notice to Proceed was issued to R.D. Edmunds & Sons, Inc., with the lowest responsive bid of $5,532,195.50, on August 2, 2005. The contract start date was August 12, 2005.

Underground utility construction by the general contractor for sewer separation included installation of 8,380 LF of new sewer pipes, rehabilitation of 3,040 LF of existing sewer pipes, 13,825 LF of new drain pipes and 970 LF of new water pipe. The new and rehabilitated sewer and drain pipes installed in the combined sewer drainage basin are shown on Figure 3-6. In addition to and as a result of resolution of utility conflicts, MWW removed and replaced 250 LF of water mains and rehabilitated 4,640 LF of existing water mains; Keyspan removed and replaced 8,895 LF of gas mains.

Surface reconstruction completed as a result of and in addition to sewer separation included approximately 4.2 miles of road reconstruction, 7,395 LF of new and reset curbing, 76 new pedestrian ramps and 5,480 LF of new sidewalks.

The Lorraine Street and Bremer Street CSO outfalls were converted to a drainage outfall discharging to the Merrimack River.

The CSO NPDES outfalls 025 and 024 were officially eliminated on July 17, 2007, and August 15, 2007, respectively. Note that CSOs from NPDES outfall 022 were eliminated in the South Main Street (North) sewer separation project. The project was completed on May 31, 2008, and the final cost for construction was $6,522,519.94. The final cost was higher than the award of the contract primarily because additional sewer repair work on Beech Street, Cheney Place, Adeline Street, Youville Street, Lorraine Street and Reed Street was added by change orders.

3.7.3 Results

Sewer separation resulted in more than 7.5 miles of new or rehabilitated drain, sewer, water and gas pipes within the three drainage basins. CSO elimination from the Lorraine Street and Bremer Street drainage basins reduced about 1.4 MG of untreated CSO discharge to the Merrimack Rivers annually.

6 new outfalls were constructed in Phase I to separate stormwater flows

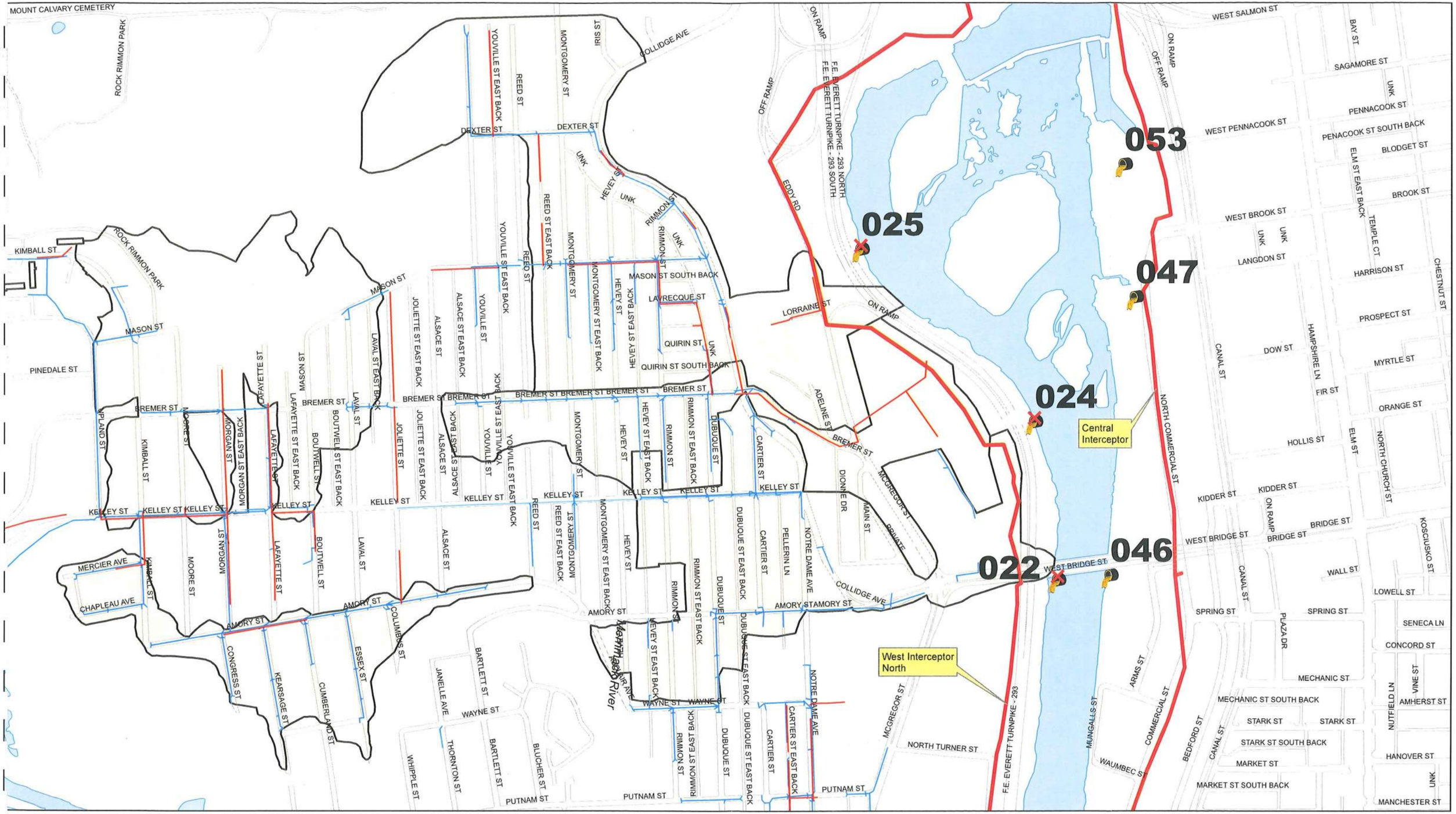
3.8 Poor Street and Schiller Street CSO Separation Project

3.8.1 Background

A preliminary design report for the Poor Street (009) and Schiller Street (011) CSO drainage basins was completed by CDM in March 2003. Both drainage basins are adjacent to each other along the Merrimack River, to which the CSOs discharge. The Poor Street and Schiller Street drainage basins have a total area of approximately 92 and 216 acres, respectively, of which approximately 25 and 55 acres, respectively, were served by a combined sewer system.

The CO required partial separation of the Poor Street drainage basin to reduce the frequency of CSO discharges. Because of the CSO separation program's success, however, the city decided completely separated the drainage basin and eliminated the CSO.

Based on the preliminary design analysis CDM determined that most of the combined sewer pipelines were not sufficiently sized to convey the design storm in either drainage basin. To separate the basins, therefore, new storm drains were required, and the combined system was



Legend

- Remaining Combined Sewer Overflow
- Eliminated Combined Sewer Overflow
- Sanitary Interceptors
- Previously Combined Area
- New Sewer
- New Drain
- CIPP Lining

CDM

W. Bridge Street (022), Bremer Street (024) and Lorraine Street (025) CSO Basins
New Sewer and Drain Pipes

Figure 3-6

converted to a sanitary sewer. Sanitary sewers found in poor condition based on CCTV inspections were replaced or rehabilitated as necessary. The preliminary design report recommended sewer separation required for both drainage basins be combined into one construction contract.

3.8.2 Project Implementation

Final design Contract Documents were prepared by Metcalf & Eddy and publicly bid on July 18, 2006, with bids received from two pre-qualified contractors. The Notice to Proceed was issued to Park Construction Corp., with the lowest responsive bid of $4,760,869.00, on October 2, 2006. The contract start date was also October 2, 2006.

Underground utility construction by the general contractor for sewer separation included installation of 1,565 LF of new sewer pipes, rehabilitation of 1,770 LF of existing sewer pipes, 11,510 LF of new drain pipes and 105 LF of new water pipe. The new and rehabilitated sewer and drain pipes installed in the combined sewer drainage basin are shown on Figure 3-7. In addition to and as a result of resolution of utility conflicts, MWW rehabilitated 850 LF of water mains, and Keyspan removed and replaced 2,120 LF of gas mains.

Surface reconstruction completed as a result of and in addition to sewer separation included approximately 2.1 miles of road reconstruction, 3,135 LF of new and reset curbing, two new pedestrian ramps and 980 LF of new sidewalks.

The new storm drains were connected to separated drainage systems throughout the basins, and both CSO outfalls were converted to storm drain outfalls discharging to the Merrimack River.

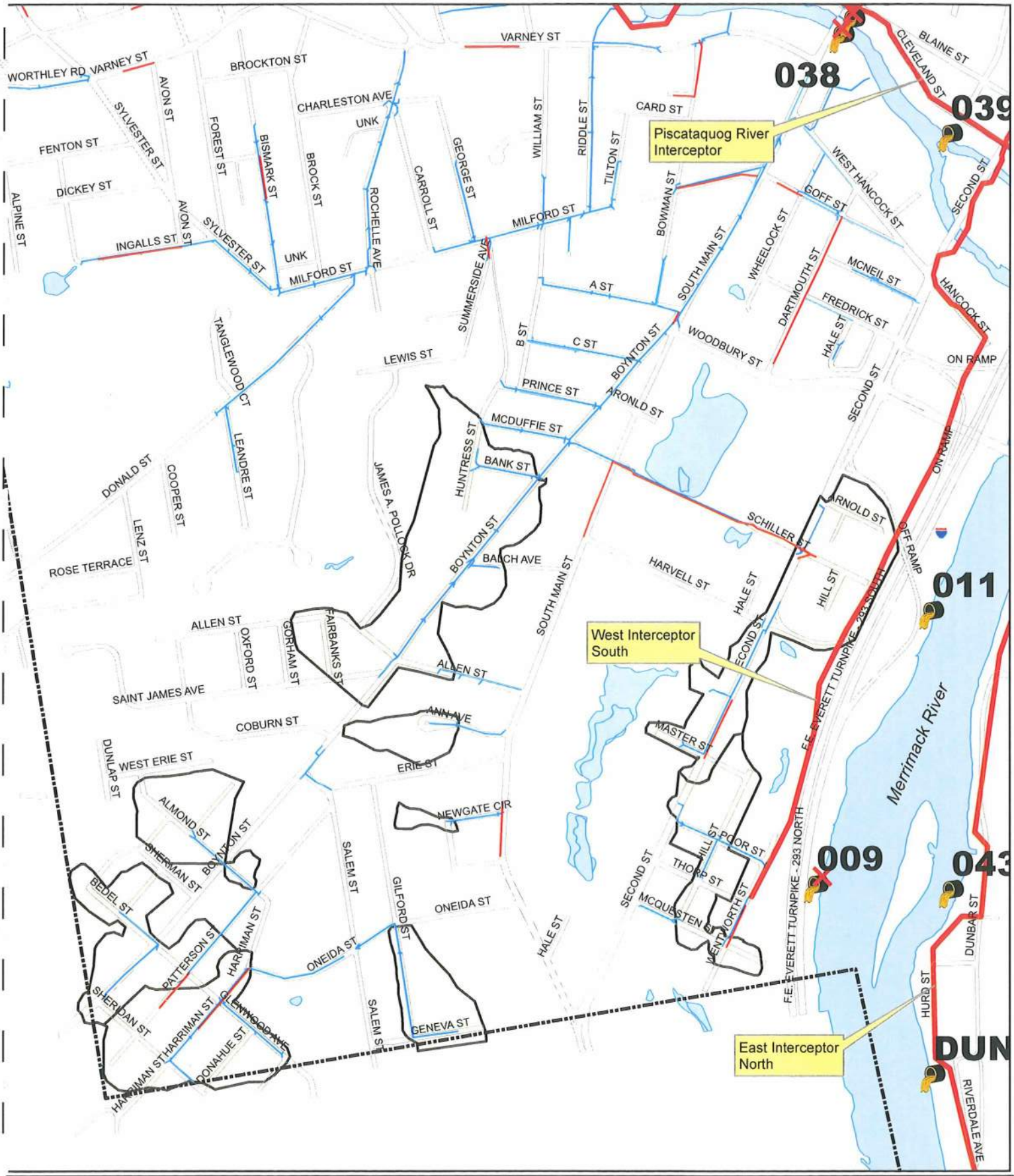
The CSO NPDES outfall 009 was officially eliminated on February 18, 2008, and converted to a drainage outfall. The regulator at the NPDES outfall 011 was modified to reduce CSOs and eliminate drainage from entering the sanitary sewer system. This was done by eliminating the current weir wall, which had directed the drain into the sewer system, and installing a new weir wall. The new weir wall was placed in front of the overflow pipe's outlet into the regulator manhole at a higher elevation. Its elevation, as well as potential elimination of CSOs by abandoning the overflow pipe, will be further evaluated during the development of the Phase II CSO LTCP.

The final project completion date was scheduled for October 31, 2008, and the final cost for construction was $4,154,727.75.

Significant bypass pumping of existing flows was often required to rehabilitate or replace existing sewers.

3.8.3 Results

Sewer separation resulted in 3.4 miles of new or rehabilitated drain, sewer, water and gas pipes within the two drainage basins. CSO elimination from the Poor Street drainage basins reduced about 0.8 MG of untreated CSO discharge to the Merrimack Rivers annually. CSOs from the Schiller Street drainage basin has been reduced by approximately 3.7 MG and will not discharge during a typical year.



Legend

- Remaining Combined Sewer Overflow
- Eliminated Combined Sewer Overflow
- Sanitary Interceptors
- Previously Combined Area
- New Sewer
- New Drain
- CIPP Lining

CDM

Poor Street (009) and Schiller Street (011) CSO Basins New Sewer and Drain Pipes

Figure 3-7

3.9 Crescent Road, Third Street and Turner/Ferry Streets CSO Separation Project

3.9.1 Background

A preliminary design report for the Crescent Road (042) CSO drainage basins was completed by CDM in September 2004. The drainage basin is on the east side of Manchester and discharges to the Merrimack River. The Crescent Road drainage basin has a total area of approximately 895 acres, of which about 56 acres were served by the combined sewer system.

The preliminary design field investigations identified one key combined sewer manhole with a cross connection to the Tannery Brook (043) CSO drainage basin. This manhole allows approximately one third of the upstream flow (dry and wet weather) to discharge to the Crescent Road drainage basin and two thirds of the flow to discharge to the Tannery Brook drainage basin. The city also had significant reports of street flooding and sewer service backups upstream of this location. Separation and sewer rehabilitation of the upstream area was therefore added to the Crescent Road CSO separation project by the city.

Based on the preliminary design analysis, CDM determined most of the combined sewer pipelines were not sufficiently sized to convey stormwater flows from the 10-year design storm in either drainage basin. To separate the basin, new storm drains were required, and the combined system was converted to a sanitary sewer. Because of separated storm drainage throughout the area, however, combined sewers were separated and redirected to existing drainage systems with new drain pipes. Sanitary sewers found in poor condition based on CCTV inspections were replaced or rehabilitated as necessary.

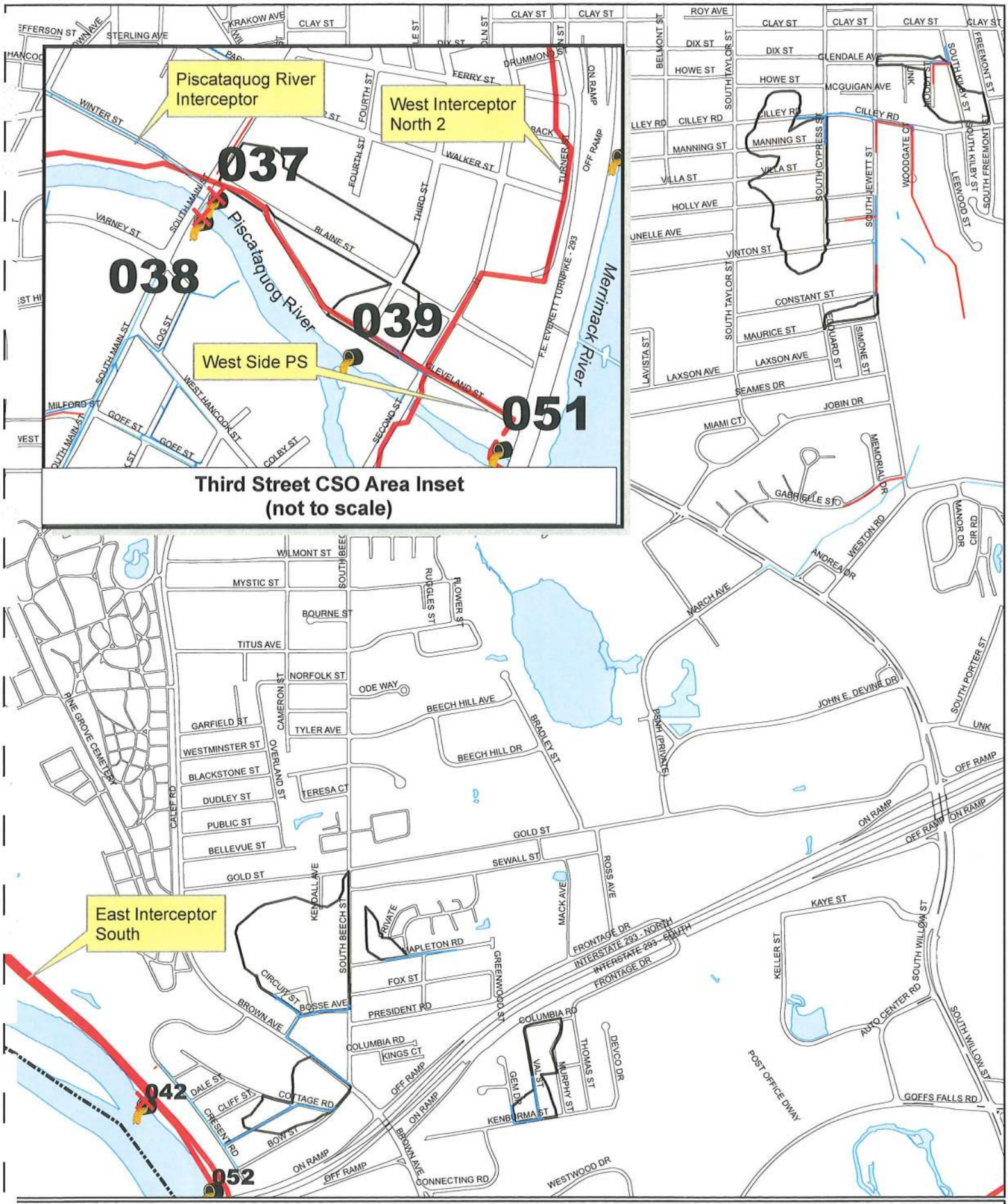
Preliminary and final design for the Third Street CSO drainage basin was completed with the design of the South Main Street (North) CSO Separation project. However, differing field conditions were found during construction, requiring redesign of the drainage basin. This work was added to the Crescent Road CSO separation project.

Paragraph IV.6 of the Compliance Order requires the City to complete modifications to the Turner/Ferry Streets (018) CSO structure to reduce the frequency of CSO discharges from the outfall. Based on flow monitoring and modeling completed on the west side of Manchester in 2008 (see Section 6 for further discussion), CSOs from the Turner/Ferry Streets CSO outfall were active about five or six times per year on average. Therefore, a design to re-configure the Turner/Ferry Streets CSO structure was completed and the work was added to the existing Crescent Road and Third Street sewer separation construction contract via a change order.

3.9.2 Project Implementation

Final design Contract Documents were prepared by CDM and publicly bid on April 12, 2007, with bids received from three pre-qualified contractors. The Notice to Proceed was issued to the construction general contractor, The Dow Company, Inc., with the lowest responsive bid of $4,189,555.00, on June 1, 2007. The contract start date was June 4, 2007.

Underground utility construction by the general contractor for sewer separation included installation of 5,500 LF of new sewer pipes, rehabilitation of 4,625 LF of existing sewer pipes, 8,835 LF of new drain pipes and 580 LF of new water pipe. The new and rehabilitated sewer and drain pipes installed in the combined sewer drainage basin are shown on Figure 3-8. In addition to and as a result of resolution of utility conflicts, MWW removed and replaced 550 LF of water mains, and Keyspan removed and replaced 2,940 LF of gas mains.



Legend

- Remaining Combined Sewer Overflow
- Eliminated Combined Sewer Overflow
- Sanitary Interceptors
- Previously Combined Area
- New Sewer
- New Drain
- CIPP Lining

Crescent Road (042) & Third Street (039) CSO Basins
New Sewer and Drain Pipes

Figure 3-8

More than 14 miles of old cast iron gas mains were replaced with new pipe to resolve utility conflicts with the CSO separation projects.

Surface reconstruction completed as a result of and in addition to sewer separation included approximately 2.2 miles of road reconstruction, 6,930 LF of new and reset curbing, 17 new pedestrian ramps and 3,200 LF of new sidewalks. The new storm drains were connected to existing separated drainage systems throughout the basins. The Crescent Road CSO outfall was converted to storm drain outfalls discharging to the Merrimack River. The Third Street CSO outfall currently remains.

The CSO NPDES outfall 042 was officially eliminated on May 14, 2008, and converted to a drainage outfall. The regulators at the NPDES outfalls 039 and 018 will be evaluated during the development of the Phase II CSO LTCP. Final substantial completion was issued on October 31, 2008. Additional Change Order work was added to the contract for new sewer on Gabrielle Street, sewers (both replacement and rehabilitation) on Union Street, emergency response to sewer backup at 538 Lake Avenue, drain repair at Merrimack Street, sewer replacement on Lowell Street back alley north, and the reconfiguration of the Turner/Ferry Streets CSO. The final completion date was October 31, 2009. The estimated final contract cost is $4,848,834.13 million.

3.9.3 Results

Sewer separation resulted in 4.4 miles of new or rehabilitated drain, sewer, water and gas pipes within the two drainage basins. CSO elimination from the Crescent Road drainage basins reduced about 0.1 MG of untreated CSO discharge to the Merrimack Rivers annually. CSOs from the Third Street and Turner/Ferry Streets drainage basins have been reduced by about 1.8 MG and 0.8 MG, respectively. The CSO activation from both regulators has been reduced to less than once per year on average.

4 Section Four

Section 4
Further Evaluations of CSO Basins

4.1 Background/Overview

The CO (Paragraphs IV.10 through IV.13) required the city to further evaluate the Cemetery Brook basin and determine if swirl concentrator technology was feasible for CSO abatement. Though not required by the CO, the city also further assessed two more large CSO drainage basins (Pennacook Street and Stark Brook). The purpose of studying the three large basins was to characterize them and consider alternative CSO control strategies for each. The basins are shown on Figure 4-1 and discussed further below.

4.2 Cemetery Brook Basin Study

4.2.1 Background

The Study of Cemetery Brook CSO Drainage Basin, completed by CDM and dated March 2005, was submitted to the city, NHDES and EPA. The Cemetery Brook CSO drainage basin (NPDES No. 044) is approximately 4,500 acres and, in 1991, composed more than 50 percent of the city's combined sewer system. Roughly one third of this sewered area is considered a fully combined system in which no separate drainage systems exist. Another third contains stormwater systems that collect and subsequently recombine the stormwater flow into the sewer system. The remaining third, located in the easternmost part of the basin, contains separate sanitary and stormwater systems.

Cemetery Brook CSO outfalls to the Merrimack River

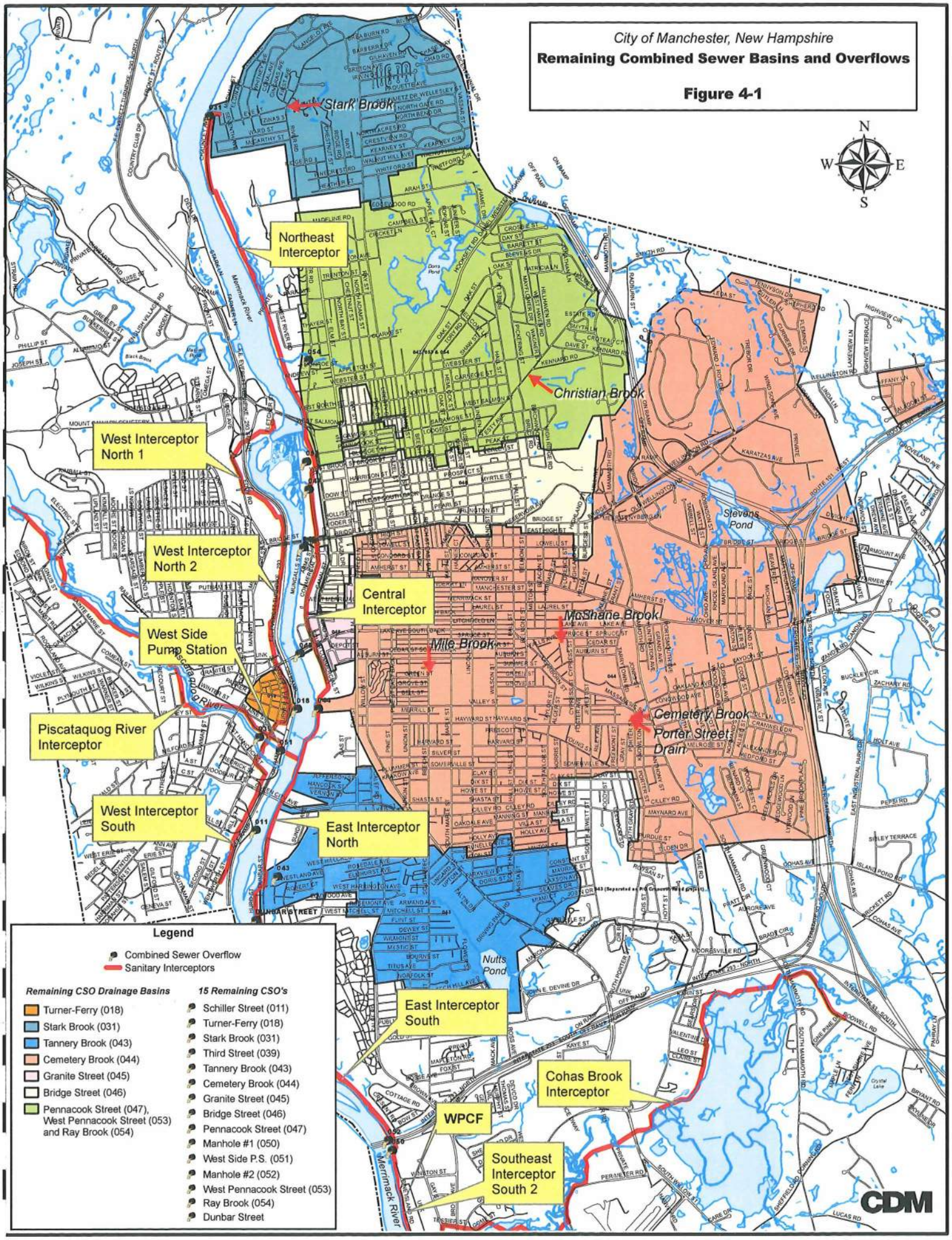
Much of the flow in the Cemetery Brook conduit comes from brooks and storm drain systems that enter the sewer system, including Cemetery Brook (outlet from Stevens Pond) and McShane Brook, and the Porter Street and Mile Brook drainage systems. During large storm events, the basin's inflow sources overwhelm and surcharge the sewer system, resulting in sewer backups and flooding.

Using the EPA's Storm Water Management Model (SWMM), average CSO discharge volumes and peak discharge rates were estimated based on flow metering in the fall of 2002 and the spring of 2003. On average, the Cemetery Brook outfall discharges 34 times per year, with a total annual average discharge of 200 MG of untreated CSOs to the Merrimack River. (The estimated annual discharges in this section are higher than estimates from the flow metering and modeling completed in the early 1990s. The revised LTCP should include additional flow metering and updated modeling analysis for future CSO abatement planning.)

4.2.2 Alternatives Analysis

The comprehensive assessment evaluated and analyzed 14 alternatives, model simulations, storage and treatment requirements, and feasible storage and treatment technologies. These alternatives considered:

- Removal of the brook flow and some storm drain systems
- Consolidated storage and/or treatment facilities at the CSO outfall


City of Manchester, New Hampshire
Remaining Combined Sewer Basins and Overflows
Figure 4-1
N
W
E
S
Stark Brook
Northeast Interceptor
Christian Brook
West Interceptor North 1
West Interceptor North 2
Central Interceptor
West Side Pump Station
McShane Brook
Mile Brook
Piscataquog River
Piscataquog River Interceptor
Cemetery Brook
Porter Street Drain
Stevens Pond
West Interceptor South
East Interceptor North
Nutts Pond
East Interceptor South
Cohas Brook Interceptor
WPCF
Southeast Interceptor South 2
Merrimack River
Legend
Combined Sewer Overflow
Sanitary Interceptors
Remaining CSO Drainage Basins
Turner-Ferry (018)
Stark Brook (031)
Tannery Brook (043)
Cemetery Brook (044)
Granite Street (045)
Bridge Street (046)
Pennacook Street (047), West Pennacook Street (053) and Ray Brook (054)
15 Remaining CSO's
Schiller Street (011)
Turner-Ferry (018)
Stark Brook (031)
Third Street (039)
Tannery Brook (043)
Cemetery Brook (044)
Granite Street (045)
Bridge Street (046)
Pennacook Street (047)
Manhole #1 (050)
West Side P.S. (051)
Manhole #2 (052)
West Pennacook Street (053)
Ray Brook (054)
Dunbar Street
CDM

- Distributed CSO storage and/or treatment facilities split among 1 or 2 upstream sites and a smaller downstream facility
- Partial separation of the combined sewer system
- Full separation of the combined sewer system

The availability of vacant land suitable for CSO storage and/or treatment facilities, and nearby to a CSO outfall, is always a significant challenge in developing a CSO control plan. The available land adjacent to the Cemetery Brook outfall is limited given the current and planned development in the area. The city considered two downstream sites: One was land formerly of the Jac-Pac Corporation (note that there is now planned development of this property), and the other was a group of properties along Elm Street directly adjacent to the Cemetery Brook conduit.

Recent and planned developments adjacent to the Cemetery Brook outfalls limit the land available to construct facilities to abate CSOs from the basin.

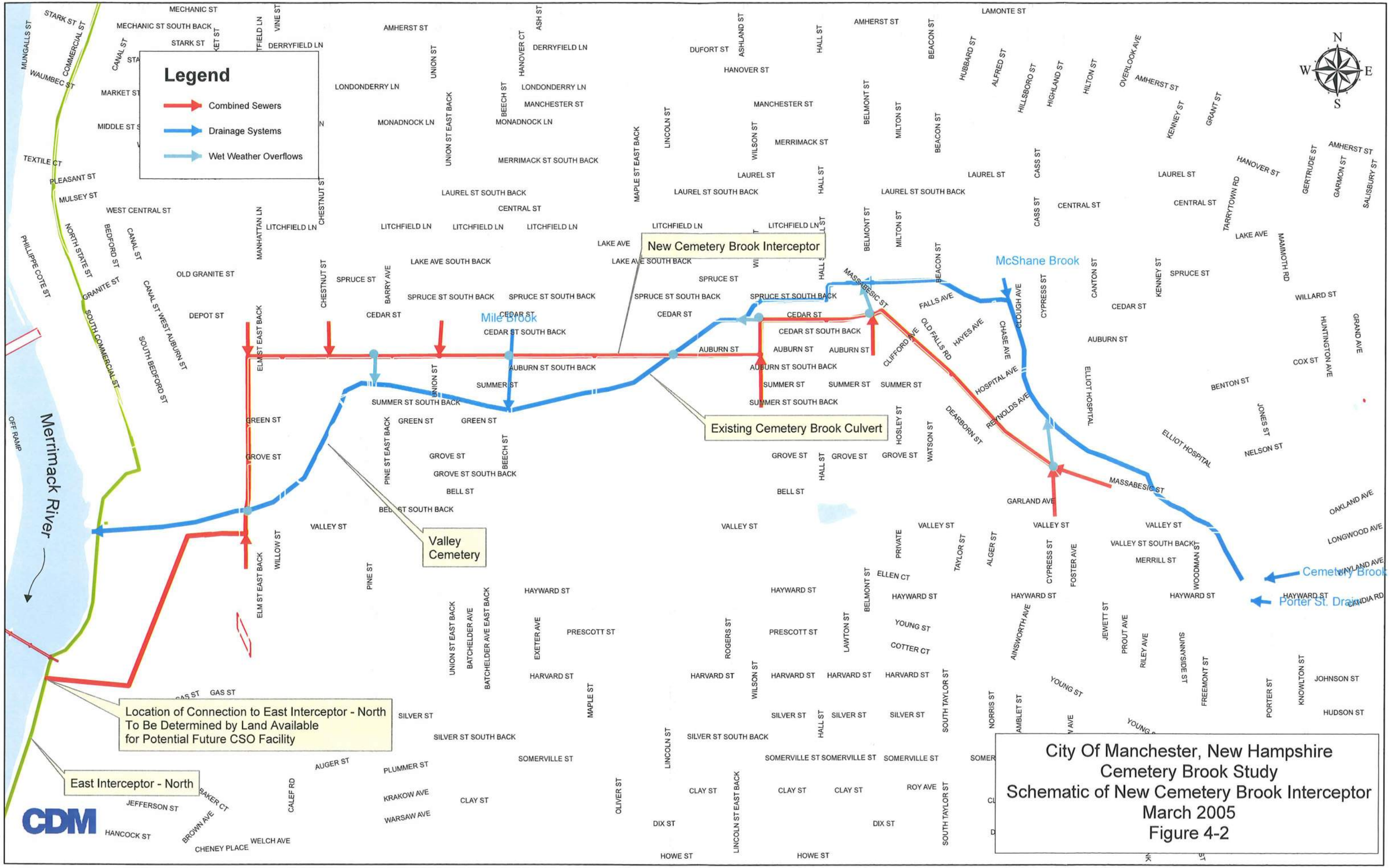
Alternatives evaluated during the study to reduce or potentially eliminate a downstream facility included sewer separation and upstream CSO facilities. The effectiveness of a full separation program depends on the inflow identification and removal program. If all public and private inflow sources are completely disconnected from the sanitary sewer system in the Cemetery Brook basin, no downstream storage or treatment facility would be required. However, experience with other similar CSO projects indicates this would be difficult to achieve, especially in urbanized areas like the downtown part of this basin. The study determined that potential upstream sites for a CSO facility could not control all the flows generated by the Cemetery Brook basin. Accordingly, all alternatives for CSO abatement will most likely require a downstream CSO storage or treatment facility.

The study also considered removal of brooks from the Cemetery Brook combined sewer system. The most cost-effective solution to eliminate all brooks was a new combined sewer pipeline. The combined sewer pipeline would essentially parallel the Cemetery Brook conduit, and convey dry weather flow and some wet weather flow from the Cemetery Brook combined sewer system. Under dry weather conditions and most wet weather conditions, the Cemetery Brook conduit would function as a drain and convey strictly separated drainage and brook flow, and discharge to the Merrimack River. During significant storm events, new CSO regulators along the new combined sewer interceptor would discharge excess flow to the Cemetery Brook drainage conduit. Figure 4-2 shows the new combined sewer interceptor alternative.

For further discussion on the results and recommendations of all the CSO abatement alternatives considered, please refer to the final report prepared by CDM.

4.2.3 Summary

The analysis determined that a downstream treatment facility using screening and disinfection (provided acceptance by regulatory agencies) would be the least costly for abatement of CSOs from the Cemetery Brook basin. As stated, however, suitable land may be difficult to negotiate and possibly cost-prohibitive or unavailable. Moreover, the city would prefer to


Legend
Combined Sewers
Drainage Systems
Wet Weather Overflows
New Cemetery Brook Interceptor
Existing Cemetery Brook Culvert
Valley Cemetery
Location of Connection to East Interceptor - North
To Be Determined by Land Available
for Potential Future CSO Facility
East Interceptor - North
Mile Brook
McShane Brook
Cemetery Brook
Porter St. Drain
Merrimack River
CDM
City Of Manchester, New Hampshire
Cemetery Brook Study
Schematic of New Cemetery Brook Interceptor
March 2005
Figure 4-2

achieve CSO abatement with passive measures (sewer separation, storage, etc,) that do not require off-site treatment facilities (See Section 7). If a downstream treatment facility is not feasible, the city should consider a new combined sewer interceptor.

The proposed interceptor would begin to control CSOs from this basin for several reasons. One is its ability to use the significant drainage infrastructure within the Cemetery Brook basin effectively. Also, this new infrastructure would enable removal of Cemetery Brook, Mile Brook, McShane Brook and some storm drain systems from the combined sewer system, thus reducing sewer overflows as well as dry weather flows that the WPCF ultimately treats. Another reason is that a new interceptor significantly decreases the size of a downstream facility and provides flexibility to continue to separate parts of the combined sewer system. Such separation may be necessary to eliminate upstream sewer surcharging that results in street flooding and sewer backups.

Valley Cemetery prior to an overflow event

4.2.4 Swirl Concentrators

Swirl concentrators were proposed during the 1995 LTCP. Paragraphs IV.10 through IV.13 of the CO discussed the evaluation and potential pilot testing of this treatment technology. Generally, the land requirements of a swirl concentrator treatment facility for the Cemetery Brook CSO basin exceeded the land areas required either for more standard treatment or for a storage facility. Land availability near the Cemetery Brook outfall is limited due to a city development project completed after the LTCP. Accordingly, because of the uncertain treatment capabilities of the technology (noted in the report) and the land requirements for an appropriately sized facility, swirl concentrators were not considered further in the Cemetery Brook drainage basin study, and pilot testing was not necessary.

4.2.5 Valley Cemetery Issues

The Cemetery Brook combined sewer conduit conveys flow through the Valley Cemetery, a historic landmark. Historically, the existing piping network in and downstream of the Valley Cemetery results in surcharges during significant storm events and wet weather flow fills a large depression area of the cemetery up to 10-feet above ground, inundating several graves and markers that are located nearby the pipe. Surcharge flow exits the pipe via a grated opening in the roof of the box culvert (on the east side of the cemetery near Pine Street) and site drainage catch basins. Over time, the surcharging to these pipelines has resulted in some structural damage to the pipe and sinkholes in this area of the cemetery. The openings to the sewer pipe also result in odor complaints from residents adjacent to the cemetery, as well as pose a potential health risk of walking by after a storm. The location of the Valley Cemetery is shown on Figure 4-2. Improvements in the cemetery should be considered during the development of the CSO abatement plan for the Cemetery Brook drainage basin.

The recent "Preliminary Design Report for Valley Cemetery Sewer Replacement" report, completed by CDM and dated June 2007,

identified two feasible alternatives (Alternatives 2 and 3) for a new replacement piping system that will reduce and/or eliminate discharge of combined sewage into the Valley Cemetery. Alternative 2 consists of approximately 1,850 LF of 10-foot box culvert. The culvert alignment runs parallel and to the west of the existing Cemetery Brook Conduit within the cemetery, turns west and travels along Grove Street and across Elm Street before reconnecting with the existing conduit approximately 160-feet west of Elm Street. This alternative includes difficult construction issues, including deep excavation (up to 35-feet) and dewatering.

Valley Cemetery during an overflow event

Alternative 3 consists of approximately 900 linear feet of twin 6-foot high by 10-foot wide box culverts within the Valley Cemetery. The proposed conduit would be installed within the existing alignment of the Cemetery Brook Conduit through the cemetery. Additionally, this alternative requires the relocation of the existing connection points to the Cemetery Brook Conduit for the interceptors from the Elm Street (North) and Elm Street (South) basins. This would be accomplished by installing approximately 300 linear feet of 66-inch reinforced concrete (RC) sewer for the Elm Street (North) basin and approximately 150 linear feet of 54-inch RC sewer for the Elm Street (South) basin.

For the existing 25-year storm event, the analyses concluded that both Alternatives 2 and 3 are capable of conveying the flows with minimal surcharging (no street flooding). However, for the "future flowrate" scenarios, the analysis concluded that Alternative 2 experienced minimal surcharging in the downstream segments, while Alternative 3 experienced significant flooding throughout the system. Therefore, it was concluded that Alternative 3 would only be sufficient to solve the basin's current problems, and would not allow for significant improvements to be made in the upstream reaches of the Cemetery Brook basin. Based on Alternative 2's capability of conveying both the current and future flowrates, this alternative may be a more appropriate long-term fix for the Cemetery Brook basin, although the difficult issues associated with this alternative would need to be further evaluated during the final design phase to determine the feasibility of construction. While Alternative 3 offers a cost savings over Alternative 2, it comes at the expense of conveying future, higher flowrates from this basin.

4.3 Pennacook Street Basin Study

4.3.1 Background

The *Study of Pennacook Street CSO Drainage Basin*, completed by CDM and dated January 2006, was submitted to the city, NHDES and EPA. The report was not required by the CO, but the city proceeded with assessing this basin further because of its hydraulic connection to the Cemetery Brook basin. The study assessed CSOs from the Pennacook Street (NPDES No. 044),

West Pennacook Street (NPDES No. 053) and Ray Brook (NPDES No. 054) CSO outfalls. The study area was approximately 1,500 acres, 600 of which are served by a combined sewer system. Similar to the Cemetery Brook basin, the Pennacook Street basin has inflow from a brook and storm drain systems that enter the sewer system, including Christian Brook. During large storm events, the basin's inflow sources overwhelm and surcharge the sewer system, resulting in sewer backups and flooding.

Using the SWMM model, average CSO discharge volumes and peak discharge rates were estimated based on flow metering in the fall of 2002 and the spring of 2003. On average, the Pennacook Street outfall discharges 46 times per year, with a total annual average discharge of 62 MG of untreated CSOs to the Merrimack River.

4.3.2 Alternatives Analysis

The comprehensive assessment evaluated and analyzed alternatives based on available properties, model simulations, storage and treatment requirements, and feasible storage and treatment technologies. These alternatives considered:

- Downstream storage or treatment with minimal upstream separation
- Christian Brook separation with downstream storage or treatment
- Full separation of the combined sewer basin

The results and recommendations are summarized below. For further discussion of all the alternatives considered for the CSO outfalls, please refer to the final report.

4.3.3 Ray Brook CSO Outfall

The Ray Brook CSO outfall was discovered during the Pennacook Street CSO basin study. The outfall was not known during the development of the original LTCP. The discovery was reported to the EPA and NHDES. The alternatives analysis determined that a new 48-inch-diameter pipe from West North Street up to Ray Brook (a distance of 1,600 feet) would abate overflows from the Ray Brook CSO. Accordingly, given the need to address the downstream capacity constraints, as well as the relatively low construction cost for a new River Road pipe, additional conveyance to control CSOs from the Ray Brook regulator is more cost-effective than separation and storage alternatives. However, the impact of additional conveyance on the downstream piping should be examined further before implementing this modification.

4.3.4 Pennacook Street CSO Outfall

Similar to Cemetery Brook, the available land adjacent to the Pennacook Street outfall is limited given the current development in the area. The city considered three private sites - Public Service of New Hampshire (PSNH), Brady Sullivan Tower and New Hampshire National Guard properties - but all three would pose extreme difficulty in acquiring the land, as well as potential deep excavation, pumping station or limited available area.

The analysis also evaluated an alternative to provide off-line conduit storage facility in a new box culvert running south along Canal Street. Canal Street is a divided four-lane road with most of its utilities in the easternmost two lanes, leaving an available corridor in the westernmost two lanes for a new pipe for CSO storage. Since the inverts of the sewers are relatively shallow, the pipeline storage structure would not require excessive excavation and could still be drained by gravity to the central interceptor, located one block over. The Canal Street pipeline storage conduit could potentially be coordinated with future CSO abatement of the Bridge Street basin, which is immediately downstream of the Pennacook Street basin. A solution that integrates facilities for both adjacent CSO basins could be more cost-effective than discrete facilities.

Given that available land may be difficult to acquire and that the city would prefer achieving CSO abatement with passive measures (sewer separation, storage, etc,) that do not require off-site treatment facilities (See Section 7), the analysis determined that pipeline storage along Canal Street would be the most cost-effective. This plan could be integrated with limited upstream sewer separation work that may be cost-effective or necessary to eliminate upstream sewer surcharging that results in street flooding and sewer backups.

The abatement plan should also consider removing Christian Brook from the combined sewer system. Christian Brook represents a significant amount of the dry weather flow in the basin. During rain events, the drainage basin tributary to this surface water inflow is even greater. Removal of the brook flow would lower the dry weather flow to the WPCF and reduce the wet weather flow from the combined sewer system, thus reducing the size of potential downstream CSO facilities.

4.4 Stark Brook Basin Study

4.4.1 Background

The *Study of Stark Brook CSO Drainage Basin*, completed by CDM and dated October 2005, was submitted to the city, NHDES and EPA. The CO did not require the report, but the city conducted it to develop a separation plan for the basin and to address recreational uses of the Merrimack River upstream of the Amoskeag Dam. The Stark Brook CSO drainage basin is approximately 640 acres, 380 acres of which are served by a combined sewer system, including flow from Stark Brook.

Using the SWMM model, average CSO discharge volumes and peak discharge rates were estimated based on flow metering in the spring of 2003. On average, the Stark Brook outfall discharges 50 times per year, with a total annual average discharge of 33 MG of untreated CSOs to the Merrimack River.

4.4.2 Summary

Similar to the CSO drainage basins discussed above, a significant analysis was completed for this study area, including combined sewer storage, treatment and separation alternatives. The alternatives analysis determined that complete sewer separation of the Stark Brook CSO drainage basin was the most cost-effective. Further, sewer separation would completely eliminate the CSO discharges whereas CSO storage or treatment alternatives would only help control CSO discharges – during larger storm events, CSOs will still be discharged to the Merrimack River. Given that this reach of the river is used for recreational activities, the complete separation of the Stark Brook basin was also the preferred control alternative.

5 Section Five

Section 5
Supplemental Environmental Projects Program

5.1 Background/Overview

The SEPP was a cooperative effort between the city, NHDES and EPA to provide broader environmental benefits to Manchester residents. The CO (Paragraph IV.15) required the city to fund and implement the program. Implementation was monitored by the SEPP executive committee, consisting of Manchester's Mayor, the Region I – New England administrator for EPA, and the NHDES commissioner. Daily administration of the program was overseen by an advisory committee, consisting of representatives from the city, NHDES, EPA and other partnering groups, such as Amoskeag Fishways and The Nature Conservancy.

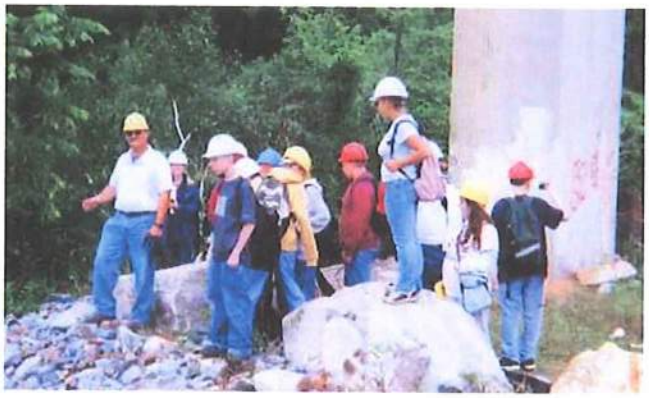
The program sought broad-based environmental and public health benefits in conjunction with infrastructure improvements to abate CSOs. This approach involved projects that benefited other areas of the city environment, such as urban ponds, streambanks, and children's health. As such, residents benefited more, and the environment received added care in some environmentally sensitive areas.

5.2 Schedule

The SEPP Workplan was submitted for review in September 1999. The entire program was scheduled, at that time, and was to be completed by March 15, 2004. During implementation, extensions were required for several projects such that the final completion date of the SEPP was December 31, 2006. A timeline for select SEPP milestones is shown in Figure 5-1.

5.3 Budget

The SEPP budget, as originally conceived in the 1999 Workplan, is found in the Preliminary Budget column of Table 5-1. Over the life of the program, some adjustments were made in the funding distribution between projects. This possibility was foreseen and allowed in the Workplan, provided adjustments were approved by the executive committee. The final expenditure for each project is given in the Final City Budget column in Table 5-1.



Through the SEPP, field trips familiarized Manchester's eighth-grade students with the local environment.

5.3.1 Leveraged Funding

The city agreed to spend $5.6 million for the SEPP. However, additional funds became available to the individual projects through generous donors and grantors, and through volunteers' in-kind donations of time and skill. These donations are included in Table 5-1.

Note that not all leveraged funds for SEPP are quantifiable. Some, such as office space and supplies for the Urban Ponds Restoration program coordinator, Manchester's environmental education program, and children's health risk education received almost $726,000 above that funded by the city, as a direct result of SEPP implementation.

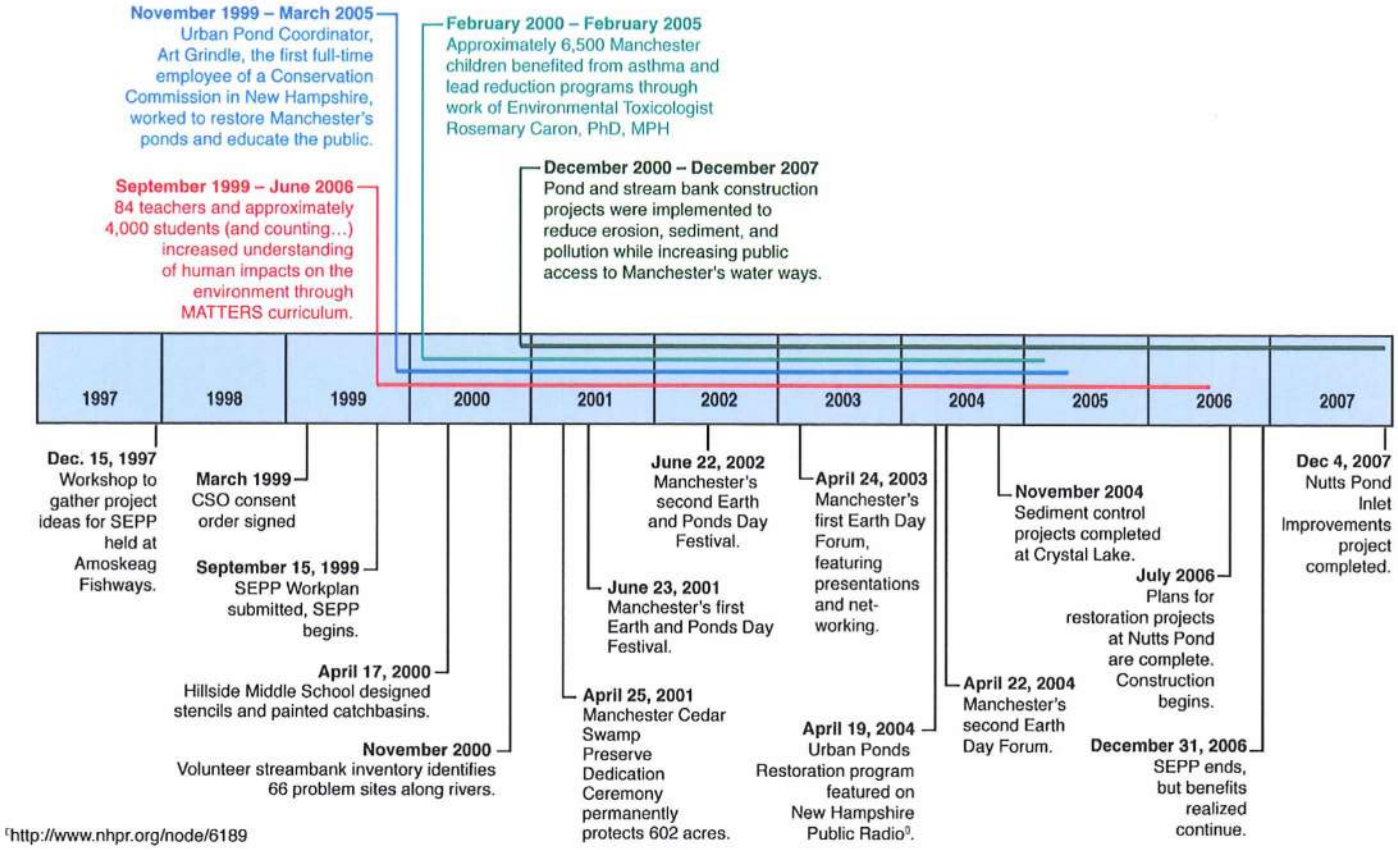


Figure 5-1
Timeline of Select SEPP Milestones

	Preliminary City Budget	Final City Budget	Leveraged Funds	Total Expenditure
Land Preservation	$2.0 Million	$2,323,300	$187,600	$2,510,900
Stormwater Management	$1.0 Million	$840,705	$200,000	$1,040,705
Streambank Stabilization	$1.0 Million	$372,018	$74,180	$446,198
Urban Pond Restoration	$1.0 Million	$893,982	$99,150	$993,132
Joint Ponds and Streambank Projects	$0	$397,578	(included in ponds & streambanks)	$397,578
Health Risk Reduction	$500,000	$499,691	$149,400	$649,091
Environmental Education	$100,000	$251,657	$75,525	$327,182
Final SEPP Reporting	$0	$21,524	$0	$21,524
Total	**$5.6 Million**	**$5.6 Million**	**$785,855**	**$6,386,310**

Table 5-1
City Budget and Leveraged Funds

5.4 Individual SEPP Projects

A brief overview of the individual projects of the SEPP follows.

5.4.1 Land Preservation

The Nature Conservancy accepted stewardship of a 602-acre preserve within the city. As a result, the rare Atlantic White Cedar/ Giant Rhododendron/ Black Gum ecosystem on Hackett Hill has been protected. A 1.8-mile trail network was established in 2003, and has received around 1,000 to 1,400 visitors per year. A kiosk constructed at the trailhead educates visitors about the preserve.

The Manchester Cedar Swamp is a globally rare Atlantic white cedar/giant rhododendron swamp. Only swamp of this kind north of Massachusetts, and one of the few in New England.

5.4.2 Stormwater Management

This project addressed stormwater runoff impacts and helped the city comply with the federal stormwater regulations, including NPDES Phase II program. Investigations to characterize the stormwater collection system were combined with stormwater treatment and public education projects to improve the quality of stormwater entering local waterways.

The City has continued funding this program and it has progressed to an implementation plan for a stormwater utility.

5.4.3 Streambank Stabilization and Erosion Control

Inventories to locate major erosion and trash dumping sites were completed. Demonstration projects followed to determine the best erosion control and public-access construction techniques. In 2004, work was done to stabilize the bank along the Piscataquog River.

5.4.4 Environmental Health Risk to Children

An environmental toxicologist worked with the city's Department of Health. She strengthened connections between local health organizations and oversaw projects to help families understand and manage children's health, especially concerning asthma and lead.

5.4.5 Urban Ponds Restoration

In addition to volunteer cleanups, public education projects, and water quality monitoring, structural water quality improvements were completed at several local ponds, including Crystal Lake, Nutts Pond and Dorrs Pond.

5.4.6 Environmental Education

An inter-disciplinary environmental curriculum was developed. Teachers and students were trained in environmental issues, and the importance of environmental stewardship was emphasized in and out of the classroom.

5.5 Results and Conclusions

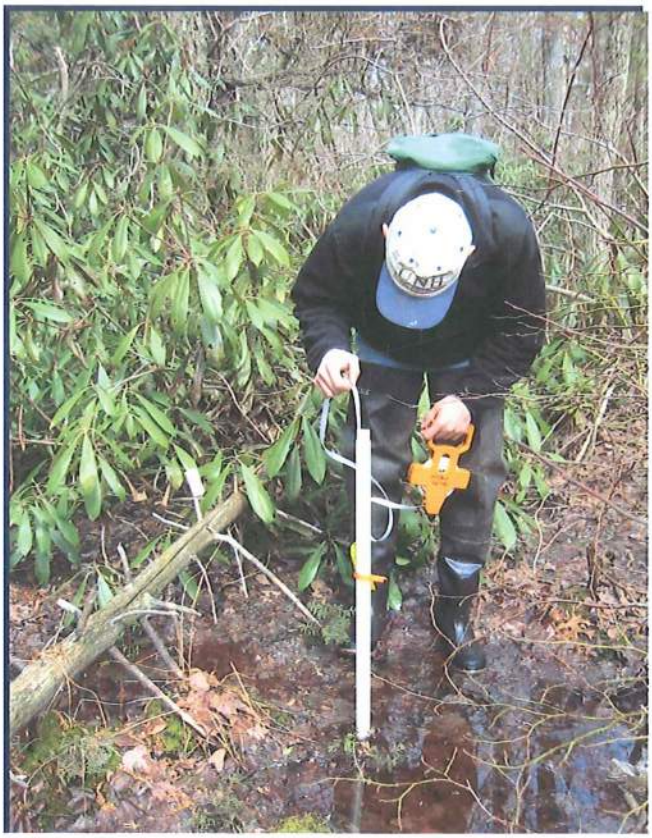
Working together with all the relevant authorities and stakeholders, the city has funded, implemented, and completed the SEPP in accordance with the Compliance Order. Manchester will continue to receive benefits from the programs initiated and implemented through the SEPP.

Overall, the SEPP was a great success for the citizens and environment of Manchester, and achieved important measurable and lasting environmental, education, and health benefits for residents.

The SEPP included tasks related to land preservation, stormwater controls, streambank stabilization, urban pond restoration, reduction of environmental health risk to children and environmental education. Details of the achievements and benefits of each of these programs were summarized in a prior CDM report, *Supplemental Environmental Projects Program Final Report*, dated December 2006.

The benefits Manchester has seen from the SEPP are numerous and long term. They are both tangible (preserved open space, eighth grade curricula, constructed stormwater and erosion controls) and less tangible (improved understanding and appreciation of the natural environment and greater communication between City departments and outside organizations).

Construction of a forebay at Nutts Pond, December 2006 (Photo Courtesy Manchester EPD)



A volunteer monitors water level at the Cedar Swamp preserve. Volunteers have been involved in trail building, hydrological monitoring, maintenance, kiosk construction, and invasive species detection and removal.

6 Section Six

Section 6
Compliance Order Reporting and Flow Monitoring

6.1 Introduction

Reporting was required by Paragraphs IV.16 and IV.17 of the CO. The required reporting included interim progress reports, work projections and WPCF wet weather monitoring.

Implementation of the Phase I CSO abatement projects also required the city to develop a flow monitoring program. The flow monitoring results would determine the effectiveness of the sewer separation program and be used to develop the city's updated LTCP.

6.2 Semi-Annual Progress Reports

Semi-annual reports discussing the city's progress during the prior half year were required to be submitted to the NHDES and EPA in January and July of each year. Manchester has submitted these semi-annual reports discussing the current status and future work projection on each CSO abatement project. A copy of the last semi-annual progress report submitted by the city appears in Appendix B.

Paragraph IV.16 of the CO also discusses the feasibility of achieving an interim CSO reduction by raising the weir elevations in the Lorraine Street (NPDES No. 025) and Turner/Ferry Streets (NPDES No. 018) regulator manholes. CSOs from the Lorraine Street drainage basin have been completely eliminated and reduction of CSOs from the Turner/Ferry streets drainage basin was achieved with a modification to the CSO structure.

6.3 Wet Weather Monitoring and Reporting

Paragraph IV.17 required the city to monitor and report on the wet weather treatment events at the WPCF. The reporting included the city's required monitoring of the NPDES effluent water quality parameters and the total flow treated at the WPCF, including primary only and primary and secondary treatment. These reports were submitted as an attachment to the semi-annual progress reports. A copy of the last report submitted by the city is included with the semi-annual progress report in Appendix B.

6.4 Flow Monitoring Program

6.4.1 Introduction

The CO required the city to develop and implement a Collection System Flow Monitoring Program for the combined sewer system and CSOs. The Flow Monitoring Program was to determine the effectiveness of the Phase I projects in reducing combined sewer discharges from Manchester's outfalls as well as to further characterize overflows from the remaining CSOs. This flow data and evaluation would then be used in developing the revised LTCP for the city, as discussed further in Section 7.

The LTCP required the city to develop and implement a Collection System Flow Monitoring Program for the combined sewer system and CSOs.

6.4.2 Original Flow Monitoring Program and Implementation Schedule

In September 1999, the city submitted a Collection System Flow Monitoring Program plan to the EPA and NHDES. The program identified three goals:

- CSO Regulator Flow Monitoring - Monitor key CSO regulators as part of a long-term monitoring program that could be used to select future cost-effective CSO mitigation measures
- Interceptor Monitoring - Monitor the combined sewer interceptor system to determine the effectiveness of sewer separation of the Phase I CSO drainage basins and any flow changes in the overall system
- Efficacy of Separation - Monitor former CSO drainage basins after Phase I sewer separation has been completed to determine the effectiveness of separation project

The Flow Monitoring Program, including the summary of gauging requirements and implementation schedule, is included in Appendix C.

6.4.3 Modified Flow Monitoring Program and Implementation Schedule

The original Flow Monitoring Program included performing flow monitoring after completion of each Phase I sewer separation project to determine the effectiveness of the sewer separation project. Therefore, after completion of the first separation contract (Theophile Street), two flow monitoring gauges were installed for six weeks in the spring of 2001 at the two major sewer connections from the basin to the Piscataquog River Interceptor. The flow metering results continued to show a response to wet weather events which was expected because not all catch basins were removed due to high construction cost (Arline Street and Tondreau Court) and private inflow connections (roof and yard drains) remained.

Since these public and private inflow connections in the Theophile Street drainage basin were known prior to flow metering, and their collective impact to the sanitary sewer system was confirmed by the data, the city established a Private Inflow Elimination Program. This program and the proposed modifications to the original flow monitoring program were documented and submitted on January 16, 2003 to the EPA and NHDES, describing the modifications to the Flow Monitoring Program. The modified flow metering schedule and a copy of the letter appears in Appendix D.

6.4.4 Status of Modified Flow Monitoring Program

The flow monitoring locations identified for CSO regulator monitoring and the monitoring status for each basin in the modified program are as follows:

- Cemetery Brook (two regulators) (044) – Performed in the fall of 2002 and the spring of 2003 during the study and evaluation of alternatives (see Section 4)
- Pennacook Street (047) - Performed in the fall of 2002 and the spring of 2003 during the study and evaluation of alternatives (see Section 4)
- Stark Brook (031) - Performed in the spring of 2003 during the study and evaluation of alternatives (see Section 4)
- Lorraine Street (025) - No longer required because the basin was completely separated and the overflow eliminated
- Turner/Ferry Streets (018) - Performed during the Spring 2008 Flow Monitoring Program (see below)

- Bridge Street (046) – Will be monitored during development of the revised LTCP for CSO abatement (see Section 7)
- Tannery Brook (043) – Will be monitored during development of the revised LTCP for CSO abatement (see Section 7)
- Granite Street (045) - Will be monitored during development of the revised LTCP for CSO abatement (see Section 7)

Flow monitoring of the city's interceptors was included in the modified program to observe the effect of the upstream sewer separation projects, quantify CSO reduction achieved, and establish a flow record of the collection system as the sanitary flow increases with population growth. The following summarizes the status of the program's key locations:

- Flow monitoring of the West Interceptor North, West Interceptor South and Piscataquog River Interceptor was performed during the Spring 2008 Flow Monitoring Program. This is discussed below.
- Flow monitoring of the Central Interceptor, East Interceptor South, East Interceptor North and Northeast Interceptor will be monitored during development of the revised LTCP for CSO abatement. This is discussed in Section 7.

After the separation work was completed for thirteen of the fifteen CSO drainage basins, the connection from the sanitary sewer to the outfalls were sealed off. Although a few catchbasins still remained in these basins, and the inflow removal program was ongoing, metering of these basins individually was not necessary. Evaluation of the efficacy of separation of these basins was accomplished by reviewing the interceptor flow metering results on the west side to determine how they collectively impact the downstream collection system, including the West Side Pump Station (WSPS). The results of this analysis are discussed further below in Section 6.6.

The two CSO drainage basins that were separated during Phase I, but the connection to the outfall remained open (Schiller Street and Third Street), were metered during the Spring 2008 Flow Monitoring Period to determine the effectiveness of the sewer separation upstream of the basin. The results of this analysis are discussed further below in Section 6.6.

6.5 Private Inflow and Infiltration Identification and Removal Program

Private inflow sources – such as sump pumps, roof leaders and yard drains – are difficult to identify, confirm and eliminate. During preliminary design of each drainage basin a windshield survey identified flat roof buildings as suspect private inflow connections. During final design, inflow questionnaires were distributed to property owners within a drainage basin. These actions helped determine potential private inflow sources in each drainage basin, but additional work would be required to confirm the connection and eliminate the source.

The city has thus established the Private Inflow and Infiltration Identification and Removal Program to eliminate these private inflow sources. This comprehensive effort to eliminate

Private inflow connections, such as flat roofs with leaders connected to the sanitary sewer system, affect sewer pipes during wet weather events.

private inflow sources was aimed at achieving a high, but cost-effective, level of sewer separation to minimize future costs to abate CSOs in other areas of the collection system.

To date, 141 private inflow sources have been removed as a result of the program's efforts. Moreover, private inflow sources have been identified for many other residential properties. Drain services were installed to the property line of many of the identified sources. The map and table in Appendix E provides the status of private and public inflow sources on the west side that are confirmed or potentially connected to the sewer.

6.6 Spring 2008 Flow Metering Program

The intent of the Spring 2008 Flow Monitoring Program was to confirm the reductions in CSOs from implementation of Phase I CSO separation work and assess the status of the four remaining CSO regulators on the west side: Turner/Ferry Streets, Schiller Street, Third Street and WSPS (See Table 6-1). Although the Schiller Street and Third Street drainage basins were separated during Phase I, the CSO outfalls remain open because they are at a lower elevation than the WSPS CSO outfall pipe and there is still combined sewer inflow connections remaining in the system that collectively exceed the capacity of the WSPS during significant rain events.

CSO Outfall	Influent Pipe	Dry Weather Pipe	CSO Pipe	Weir Crest Elevation
Schiller (011)	36"	12"	36"	125.5
Turner/ Ferry (018)	24"	12"	24"	129.2
Third (039)	12"	10"	12"	120.4
WSPS (051)	48"	Pump Station	30"	130.4

Table 6-1
Remaining CSO Outfalls on West Side

6.6.1 Summary of Field Investigations at the West Side Pump Station

Flows from the three major interceptors on the west side converge at the intersection of Second and Cleveland Streets. All flow is then conveyed through a 48-inch pipe on Cleveland Street to the WSPS. Flow enters the station from a manhole on the east side of the building into one or both of the station's two wet wells. This influent manhole also has an overflow pipe to the river. In front of the overflow pipe is an actuating gate that is in the closed position. There is an influent gate to the WSPS which is programmed to automatically modulate between opened and closed based on the water level in the wet well. The WSPS has three, approximately 6,000 gallon per minute (gpm), pumps that are programmed to operate in lead/lag/lag at predetermined wet well elevations. A set point is used in the programmable logic controller (PLC) to control the pump speed to maintain a set wet well level (i.e., the pump speed will increase or decrease as required to maintain the level).

Prior to commencing the flow metering program, a field test of the WSPS was performed to determine the actual settings and operation of the station by simulating high flow events and allowing the wet well to fill up high enough to signal the start of all three pumps and initiate closing the influent gate. These field investigations were performed on February 28, 2008. The objective was to update the PLC logic setpoints as needed. Readings were taken by connecting a laptop to the PLC at the WSPS. All elevations were confirmed by running a survey level loop down the stairs of the WSPS to the lower room above the wet wells. The operation of the pumps and gate were observed during manual manipulation of the station control to simulate conditions needed to show equipment response to wet well variation. The current observed WSPS operational settings were as shown in Table 6-2.

PLC Wet Well Level (feet)	Elev. (feet)	PLC Setting/Comments
	~90	Invert of wet well (not confirmed)
		Low water alarm (not confirmed)
1.5	94.85	Lead pump stop
2.2	95.55	Lag pump stop
2.7	96.05	Lag lag pump stop
4	97.35	Lead pump start
4.25	97.6	Dry weather level - set point
5.5	98.85	Lag pump start
6	99.35	Influent gate begins to close/modulate
6.5	99.85	Influent gate begins to open/modulate
6.5	99.85	Lag lag pump start
10	103.35	Influent gate completely closes
10.8	104.15	High water level alarm
12	105.35	High high water level alarm
	~110	Elevation of wet well covers
	~110+	Flooding of wet well room (not confirmed)

Table 6-2
WSPS Operation Settings

Influent Gate Operation

The gate operation and maintenance manual was used to verify gate operation. Per the PLC control logic, the controller uses a set point to open, close and maintain the gate level. During the tests the gate was found to start closing slowly (1 to 2 percent per minute) with a water level of 6.0 feet in the wet well. When the wet well water level reached about 10.0 feet the gate closed quickly (completely closes within 10 minutes). When the level in the wet well returns to below 6.0 feet the gate will open slowly and remain open. This field test confirmed the operation of the influent gate, which was critical to monitor during the flow metering period.

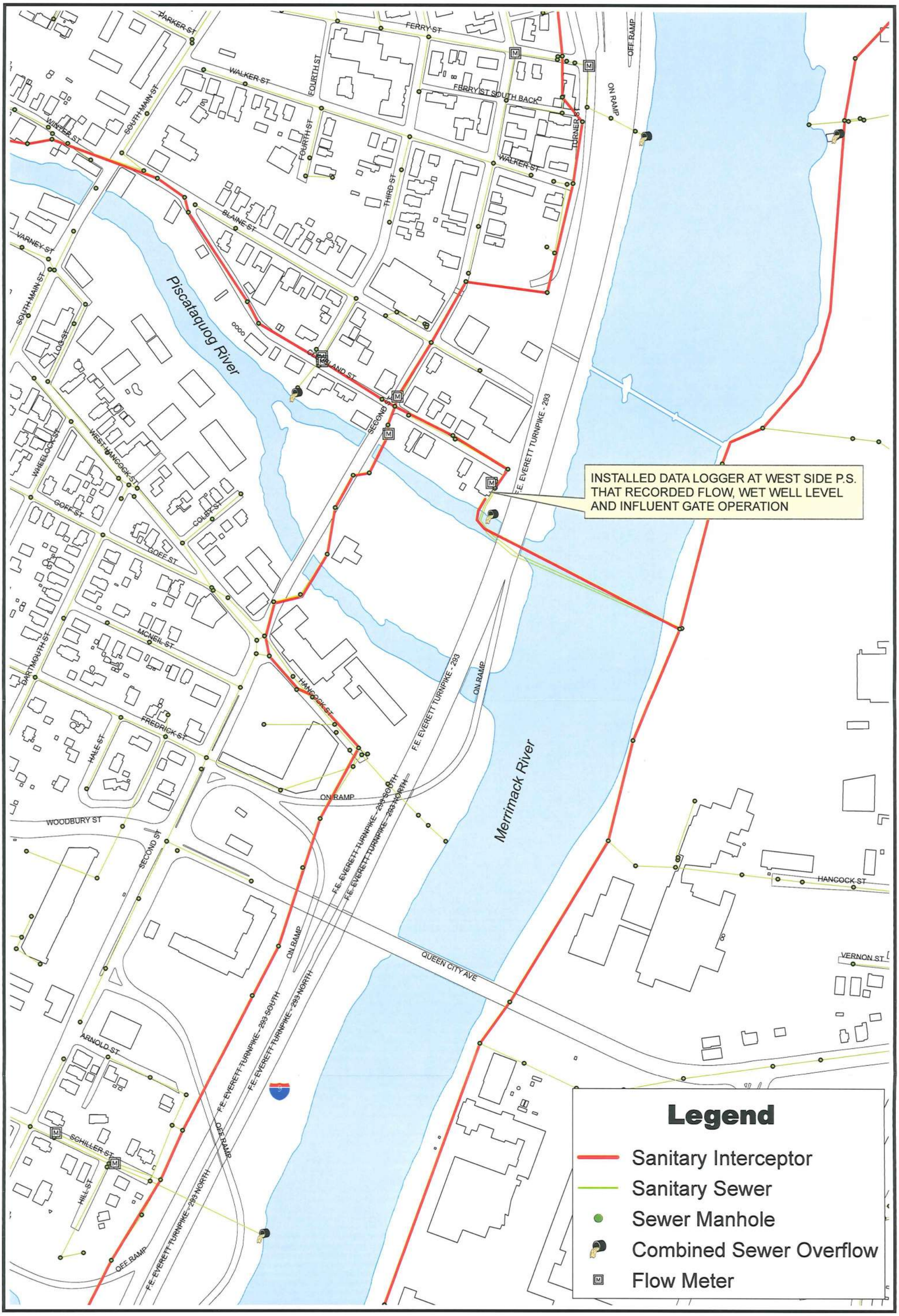
Data Logger

Due to the importance of the influent gate status to the flow metering program, a data logger was installed at the WSPS and collected data from April 8, 2008 to July 11, 2008. The data logger continuously recorded flow, wet well level and influent gate percent open for the majority of the flow metering period. The information was used to assist with the calibration of the model to the flow metering data. Also, the total flow from the three interceptors into the WSPS was compared to the flow readings collected by the data logger. The meter data compared well to the flow being recorded at WSPS by the city.

6.6.2 Flow and Rainfall Data Collected

The Spring 2008 Flow Metering Program was performed from the beginning of April to the end of June. During the program, eight flow meters and one precipitation gauge were installed at strategic locations on the west side, as shown on Figure 6-1. As shown on Table 6-3, five of the meters measured flows in sanitary pipes/interceptors and three of the meters were placed in overflow pipes. During the flow metering period, overflows were recorded at the Ferry/Turner Streets outfall for four rainfall events. No overflow events were recorded at Third Street, Schiller Street or WSPS outfalls.

The precipitation gauge was installed on the roof of the WSPS. There was a total of 9.24 inches of rainfall from the 17 measurable storm events recorded during the flow metering period. The April 28, 2008 storm was the largest rainfall event with a return period of nine months. The June 23, 2008 storm was the most intense rainfall event and also resulted in reaching the maximum pumping capacity of the WSPS and required the influent gate to the pump station to close (information collected from data logger at WSPS). The occurrence of these two events, along with a few more frequent rainfall events, ensured sufficient data to calibrate the model.



City of Manchester, New Hampshire

Phase I Flow Monitoring Program

Spring 2008

Figure 6-1

CDM

Interceptor	Catchment Area (acres)	Number of Buildings	Area of Buildings (acres)	Impervious Area (acres)	Percent Impervious (%)
Piscataquog River Interceptor	782	3,191	92	265	33.9
West Interceptor North	1,362	3,062	132	596	43.8
West Interceptor South	454	1,867	54	181	39.9

Table 6-3
Interceptor Catchment Areas, Buildings and Percent Impervious

6.6.3 Sewer Model Development

EPA's Stormwater Management Model (SWMM 5) was used to evaluate the hydrology and hydraulics of the existing collection system on the west side. SWMM 5 is a comprehensive model for hydrologic and hydraulic analyses of urban collection systems. The model uses a non-linear reservoir algorithm to dynamically compute runoff resulting from rainfall, and dynamically routes flow, accounting for backwater and pressurized flow conditions. SWMM 5 was utilized to assess the runoff response, inflow and infiltration into the system, and the conveyance capacity of the combined and separated portions of systems under various design storms.

The city of Manchester's collection system GIS database was used as the basis for building the physical sewer network of the three interceptors (West Interceptor North, West Interceptor South and the Picscataquog Interceptor) and major sewer collectors on the west side in the model. The GIS sewer pipe coverage was used for the sewer pipe properties, such as length, shape, size and material (for estimating the roughness coefficient). The pipe coverage was also used for assigning the inverts and ground elevations for the models junction nodes (typically manholes).

Once the network was built, the critical elevation and/or size of interceptors, ground surface and CSO outfalls were verified against as built drawings. Also, where available, the model data was verified against field inspection data.

6.6.4 Boundary Conditions

All three of the west side interceptors converge just upstream of the WSPS. At the pump station, the water level in the wet well is maintained to control the flow of water to the pumps. Therefore, the hydraulic grade line (HGL) of the wet well is the boundary condition for all three interceptors. The HGL in the wet well is maintained at approximately elevation 97.6-feet during dry weather conditions with one pump in operation. However, during wet weather events, the level in the wet well rises (which automatically turns on additional pumps at preset elevations in the wet well) and reaches a point where the influent gate begins to modulate closed to limit the flow to the station. The observed flow data suggests that the maximum flow being pumped by the station is approximately 20 MGD.

The SWMM model was configured with a wet well and an orifice representing the gate that mimicked the actual gate operation collected by the data logger at the pump station. This allowed for the calibration of the model to the water levels maintained in the wet well during high flow conditions.

6.6.5 Hydrology

SWMM5 requires the input of several parameters to determine the rainfall-runoff response from modeled catchments. These include area, width, imperviousness, ground slope, roughness coefficient for pervious and impervious areas, depression storage for pervious and impervious

areas, and soil infiltration parameters. ArcMap GIS software was used to delineate sub-catchments tributary to each interceptor and the effective impervious area (i.e. buildings, parking lots, driveways, sidewalks and roads). Percent of impervious area was calculated based on the actual impervious area within the sub-catchment, as shown on Table 6-4.

Site	Location	Pipe Diameter (inches)	Type
1	Schiller St.	8	Overflow
2	Schiller St. at Hill St.	12	Sewer
3	Cleveland St. at Third St.	10	Overflow
4	Second St. near Cleveland St.	18	West Interceptor South
5	Second St.	36	West Interceptor North
6	Cleveland St. at Third St.	36	Piscataquog Interceptor
7	Ferry St.	24.8	Sewer
8	Turner St. at Ferry St.	24	Overflow

Table 6-4
Spring 2008 Flow Monitor Locations

6.6.6 Dry Weather Flow

The flow monitoring program provided flows from all three main interceptors which covers the entire collection system draining to the WSPS. CDM evaluated the data and utilized a computer program, SHAPE, to separate the flows into weekday and weekend based wastewater flow and groundwater flow - the two components that make up dry weather flow. Also, flow records by the city were obtained for Saint Anselm College and the town of Goffstown, both of which discharge to the city's sewer collection system on the west side.

6.6.7 Groundwater Depths

During the Spring 2008 Flow Monitoring Program, piezometers were installed at three locations to monitor groundwater at Schiller Street, Second Street and Turner Street. Also, a long-term record of groundwater was obtained from the USGS NWIS database for the groundwater well NH-WCW 1 in Warner, NH. The groundwater level trends collected during the Flow Monitoring Program are similar to the trend of the NH-WCW1 level during the same period. Thus, when evaluating long-term simulations in the model the trend of the NH-WCW1 depth to groundwater level was used.

6.6.8 Rainfall Simulations

The purpose of rainfall simulations was to evaluate the collection system, CSO overflow activation, and overall effectiveness of the Phase I CSO abatement program. First, one month of baseflow (May 18 to June 18) from the calibration simulation was used for the rainfall simulations. Next, 5 years of continuous rainfall from 2001 through 2005 was input into the model, as well as simulations of 10-year and 25-year 24-hour design storms. The 5 years of data provided actual rain events while the 10 and 25 year events are Soil Conservation Service (SCS) type III design storms.

6.6.9 Model Results

Upon completion of the Turner/Ferry CSO modifications, the model was updated to simulate the current conditions at the end of Phase I. The results of the rainfall simulations determined that from Manchester's west side the annual average CSO overflow volume is now about 0.2 million gallons and the average duration of CSO dischares is now less than 1 hour per year. In general, the west side is controlled to about the 2 year peak hour intensity storm event and there is less than one overflow per year on average. This significantly exceeds the goal of the Phase I CSO Abatement Program of controlling the remaining west side overflows to at least a three month level of control.

7

Section Seven

Section 7
Status of Phase I Program and Future Goals

Manchester's CSO abatement is a phased program. Phase I implemented several projects, primarily on the city's west side, over a ten-year period, and also will reassess appropriate CSO control of the rest of the city. Having completed Phase I construction work, the city is now preparing to revise its LTCP and planning for future CSO abatement projects.

7.1 Status of Phase I

The city's CO outlined the requirements/tasks for Phase I in 17 paragraphs (IV.1 through IV.17). These requirements were to be met within ten years (by March 15, 2009). Phase I focused on 16 combined sewer drainage basins. Thirteen were to be fully separated, one was to be partially separated, and two were to have flows further controlled by weir modifications. The city also was required to construct a new secondary treatment wet weather diversion pipe at the WPCF, complete the SEPP program, and further evaluate the Cemetery Brook drainage basin.

The city went above and beyond Phase I requirements and *fully* separated two additional basins originally targeted for only partial separation or weir modifications. Figure 7-1 shows the 15 drainage basins fully separated during Phase I. Moreover, as shown in Table 7-1, all Phase I CSO separation projects were completed in 2008, nearly one year ahead of schedule. These abatement projects, including the full separation of two additional basins not required by the CO, were completed under the original program budget (in 1994 dollars).

The estimated CSO reduction for each separated basin is discussed in Section 3. The estimated total CSO reduction during an average year for the entire collection system on the west side of Manchester is about 53 MG based on the 1995 LTCP. Further, based on flow monitoring and modeling completed on the west side of Manchester in 2008, the CSO activation has been reduced to an annual average CSO discharge of about 0.2 MG. This is a 99 percent reduction in CSO discharges from the west side in 10 years.

In general, the west side is now controlled to about the 2 year peak hour intensity storm event and there is now less than one overflow per year on average. This exceeds the goal of the Phase I program which was to provide a 3 month level of CSO control from the four outfalls remaining on the west side. The goals of Phase I were documented in the City's "CSO Long-Term Control Plan and Phase I Implementation Schedule" report, which was submitted to the EPA and NHDES in January 1999.

In summary, the Phase I CSO abatement program was completed under budget, ahead of schedule, included more system improvements than originally planned, and achieved a higher CSO level of control than expected. Overall, the successful program was very effective and similar CSO abatement alternatives should be considered in future planning.

7.2 Requirements of Revised LTCP

Paragraph IV.14 of the CO requires the city to submit to the EPA/NHDES a revised LTCP for CSO abatement by March 15, 2010 (within eleven years of receipt of the CO). The revised LTCP must comply with the Clean Water Act, and state and federal CSO policies. It must include:

- Evaluation of the overall effectiveness of the Phase I LTCP projects
- Updated alternative analysis for each remaining CSO (seven basins and 15 outfalls)

City of Manchester, New Hampshire

Phase I Sewer Separation Program

Figure 7-1

Merrimack River

Maxwell Pond

Dorrs Pond

Stevens Pond

Nutts Pond

Cohas Brook

Piscataquog River

030

054

053

025

047

024

046

022

032

033

034

045

036

037

038

039

051

018

044

013

011

009

043

042

052

050

DUNBAR STREET

Northeast Interceptor

Central Interceptor

West Interceptor North 1

West Interceptor North 2

Piscataquog River Interceptor

West Side Pump Station

West Interceptor South

East Interceptor North

East Interceptor South

Southeast Interceptor South 2

Cohas Brook Interceptor

WPCF

N

W

E

S

Legend

- Combined Sewer Overflow
- Sanitary Interceptors

Separated CSO Drainage Areas

- Poor Street (009)
- Schiller Street (011)
- W. Hancock Street (013)
- W. Bridge Street (022)
- Bremer Street (024)
- Lorraine Street (025)
- Victoria Street (030)
- Electric Street (032)
- Theophile Street (033)
- Sullivan Street (034)
- Varney Street (036)
- S. Main Street (North) (037)
- S. Main Street (South) (038)
- Third Street (039)
- Crescent Road (042)

Eliminated CSO's

- Poor Street (009)
- W. Hancock Street (013)
- W. Bridge Street (022)
- Bremer Street (024)
- Lorraine Street (025)
- Victoria Street (030)
- Electric Street (032)
- Theophile Street (033)
- Sullivan Street (034)
- Varney Street (036)
- S. Main Street (North) (037)
- S. Main Street (South) (038)
- Crescent Road (042)

CDM

Item #	Description	Status	Comments
1 and 2	WPCF Bypass Pipe	Complete	Project Completed 8/11/2000
3	Flow Monitoring Plan	Complete	
4	Piscataquog River CSO Abatement Projects		
	Theophile Street (033) - Full Separation	Complete	CSO eliminated 12/21/2000
	Electric Street (032) - Full Separation	Complete	CSO eliminated 11/11/2002
	Varney Street (036) - Full Separation	Complete	CSO eliminated 12/13/2002
	Sullivan Street (034) - Full Separation	Complete	CSO eliminated 11/11/2002
	South Main Street (S) (038) - Full Separation	Complete	CSO eliminated 9/28/2004
	South Main Street (N) (037) - Full Separation	Complete	CSO eliminated 7/27/2005
	Third Street (039) - Full Separation	Complete	CSO regulator will be evaluated during development of revised LTCP
5	Merrimack River CSO Abatement Projects		
	West Hancock Street (013) - Full Separation	Complete	CSO eliminated 9/7/2004
	Victoria Street (030) - Full Separation	Complete	CSO eliminated 10/28/2004
	West Bridge Street (022) - Full Separation	Complete	CSO eliminated 10/21/2005
	Bremer Street (024) - Full Separation	Complete	CSO eliminated 8/15/2007
	Poor Street (009) - Partial Separation	Complete	CSO eliminated 2/19/2008
	Crescent Road (042) - Full Separation	Complete	CSO eliminated 5/14/2008
	Schiller Street (011) - Full Separation	Complete	CSO regulator will be evaluated during development of revised LTCP
6	CSO Weir Modifications		
	Lorraine Street (025) - Raise Weir	Complete	CSO eliminated 7/17/2007
	Turner Street (018) - Raise Weir	Complete	CSO modifications were completed on July 30, 2009
7	Complete Phase 1 within 10 years	Complete	
8	Revisions Clause	N/A	
9	Schedule	Complete	
10 and 11	Further Evaluation/Study of Cemetery Brook	Complete	Final Report submitted 3/2005
12 and 13	Pilot Testing - Swirl Concentrators	N/A	Alternative not preferred
14	LTCP for Phase II	Ongoing	Due in March of 2010
15	SEPP	Complete	Summary Report submitted 12/2006
16	Progress Reports	Ongoing	Continue submitting semi-annual reports
17	Wet Weather Monitoring/Reporting at WPCF	Ongoing	Continue submitting semi-annual reports

Table 7-1
Status of Compliance Order Requirements

- Financial impact analysis
- Recommended future CSO abatement plan with a proposed implementation schedule
- In conjunction with the EPA and NHDES, a determination of the appropriateness of a water quality variance, redesignation of receiving water uses, or temporary partial uses of receiving waters


The city's goals for future CSO abatement include removing brooks from the sewer system, such as Cemetery Brook, which is regulated under the Merchants Auto.com Stadium.

Figure 7-2 shows the seven remaining CSO drainage basins and the 15 remaining CSO outfalls. Four of the CSO drainage basins (Turner/Ferry Streets, Stark Brook, Pennacook Street and Cemetery Brook) have been further evaluated since the start of Phase I. The revised LTCP will need to include abatement recommendations for the remaining 15 CSO outfalls. At a minimum, the following flow monitoring to comply with Phase I requirements will also be needed to complete the LTCP revision:

- Bridge Street (046), Tannery Brook (043) and Granite Street (045) CSO regulators
- Central Interceptor, East Interceptor South and Northeast Interceptor

7.3 Goals for Future Work

In anticipation of future CSO abatement, the city has identified its goals for the revised LTCP, which include:

- Removing brooks from the sewer system to reduce CSO discharges to the Merrimack River while decreasing dry weather sewer flows to the WPCF
- Achieving CSO abatement with passive measures (i.e., separation and storage) versus off-site treatment facilities (i.e., screening and disinfection)
- Incorporating the results of the United States Army Corps of Engineers' (ACOE) Merrimack River study, which emphasized control of non-point sources and stormwater rather than CSO abatement for improving water quality in the watershed
- Incorporating a stormwater utility as another way of implementing stormwater projects and improving water quality

7.4 Preparation for Future Work

7.4.1 General

With construction required by Phase I completed, the city is preparing to revise the LTCP. This includes having prepared this report - not required by the CO - as well as having considered future CSO abatement options, including the city's goals for the program.

7.4.2 Merrimack River Study

Manchester is a charter member of the Merrimack River Coalition, which, along with the federal government, has funded the Merrimack River study. The study, managed by the ACOE, was a comprehensive watershed-based assessment of receiving water uses, pollutant sources, and flow characteristics that helped identify the receiving water uses and goals for the Merrimack River. The *Final Phase I Report for the Merrimack River Watershed Assessment* was completed in September 2006.

City of Manchester, New Hampshire

Remaining Combined Sewer Basins and Overflows

Figure 7-2

N W E S

Stark Brook
031
Northeast Interceptor
Merrimack River
Dorrs Pond
047, 053 & 054
Christian Brook
Black Brook
Maxwell Pond
West Interceptor North 1
West Interceptor North 2
Central Interceptor
West Side Pump Station
Piscataquog River Interceptor
Piscataquog River
West Interceptor South
East Interceptor North
East Interceptor South
DUNBAR STREET
Mile Brook
McShane Brook
Cemetery Brook
Porter Street Drain
Stevens Pond
Nutts Pond
Crystal Lake
043 (Separated as P/O Crescent Road project)
Cohas Brook Interceptor
WPCF
Southeast Interceptor South 2

031 046 047 053 054 045 048 018 044 039 051 011 043 052 050

Legend

- Combined Sewer Overflow
- Sanitary Interceptors

Remaining CSO Drainage Basins

- Turner-Ferry (018)
- Stark Brook (031)
- Tannery Brook (043)
- Cemetery Brook (044)
- Granite Street (045)
- Bridge Street (046)
- Pennacook Street (047), West Pennacook Street (053) and Ray Brook (054)

15 Remaining CSO's

- Schiller Street (011)
- Turner-Ferry (018)
- Stark Brook (031)
- Third Street (039)
- Tannery Brook (043)
- Cemetery Brook (044)
- Granite Street (045)
- Bridge Street (046)
- Pennacook Street (047)
- Manhole #1 (050)
- West Side P.S. (051)
- Manhole #2 (052)
- West Pennacook Street (053)
- Ray Brook (054)
- Dunbar Street

1,000 0 1,000 2,000 Feet

CDM

The city continues to be involved in and support the study, including meeting with the coalition to discuss the results and determine future steps for improving water quality. The coalition is focusing on the study's findings, including non-point sources and stormwater issues in the basin, and ultimately attempting to receive funding from the ACOE for the next phase, which may include pilot-scale programs.

It is recommended the city incorporates the Merrimack River study's findings into the revised LTCP. As discussed in the EPA CSO policy and program manuals, review of receiving water quality standards and water use objectives by state agencies involving all stakeholders along the river is important in setting appropriate, reasonable, and attainable goals to guide a CSO LTCP. The study represents this step in setting the environmental objectives for the river.

7.4.3 Stormwater Utility

EPD is investigating the establishment of a stormwater utility. In 2007, the city's Community Improvement Program (CIP) committee authorized expenditure for a stormwater feasibility study to determine if it makes sense economically, politically and programmatically to establish such a utility.

Establishment of New Hampshire's first stormwater utility required special legislation. A bill was approved by Senate enabling Manchester to create a stormwater utility as part of HB 664-FN effective July 1, 2007, and was signed into law by the governor on July 16, 2007.

The city hired a consulting engineer during fiscal year 2009 to perform the second phase of the study. This second phase includes the groundwork for setting rates, organizational structure, billing method, accountability, and other related actions. Creating the stormwater utility is in anticipation of future regulatory demands on stormwater infrastructure.

7.4.4 RFQ/RFP for Revised LTCP

To meet the CO schedule and submit a revised LTCP to the EPA and NHDES by March 15, 2010, the city has hired a consulting engineering firm to assist in evaluating options and developing recommendations for the revised LTCP.

7.5 Summary

Manchester's multiyear, multimillion dollar Phase I CSO abatement program has met and exceeded many of its original goals. Moreover, Phase I was completed ahead of schedule and under the original budget. As a result of this program, the city has improved the environment and overall water quality, while enhancing the quality of life for residents. Not only has the city fully separated 15 combined sewer drainage basins, in doing so it also made upgrades to utilities, roads, curbing and sidewalks. Several other benefits have been realized too through the SEPP, including preserved open space, erosion controls and environmental educational.

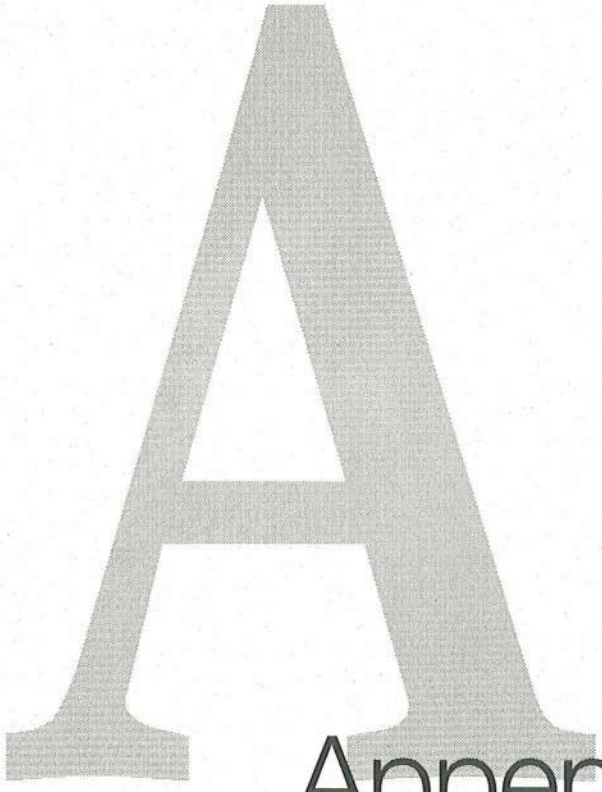
Building on the prior success, the city is now looking to the future. Its next step in meeting the CO schedule will be to submit a revised LTCP. The city has identified general goals for this next phase. One goal is to remove brooks from the sewer system to reduce sewer discharges to the Merrimack River and decrease dry weather flows to the WPCF. The city also plans to use passive measures such as sewer separation and storage to further abate CSOs. Another goal is to incorporate the findings of the Merrimack River study into the revised LTCP. Lastly, the city would like to establish a stormwater utility in anticipation of future regulatory demands on stormwater infrastructure.

With the last 10 years of successes behind it and a solid direction laid out for the foreseeable future, the City of Manchester can comfortably expect to realize even further improvements to the quality of its water resources and overall environment.

Appendices

Appendices

Appendix A	City of Manchester's CSO Compliance Order
Appendix B	Semi-Annual Progress Report and Bypass Report
Appendix C	Original Collection System Flow Monitoring Program Plan (1999)
Appendix D	Modified Collection System Flow Monitoring Program Plan (2003)
Appendix E	Status of Private Inflow Connections



Appendix A

Appendix A

City of Manchester's CSO Compliance Order

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION 1
JOHN F. KENNEDY FEDERAL BUILDING
BOSTON, MASSACHUSETTS 02203-0001

CERTIFIED MAIL - RETURN RECEIPT REQUESTED

March 11, 1999

Mayor Raymond J. Wieczorek
City of Manchester
227 Maple Street
Manchester, NH 03103-5596

Dear Mayor Wieczorek:

Enclosed is the City of Manchester's copy of the CSO compliance order. This document reflects many months of constructive discussions between EPA, Manchester, the State of New Hampshire, and environmental advocates, and the projects which will be implemented over the next ten years will bring important environmental and public health benefits to the citizens of Manchester.

We look forward to a productive working relationship with Manchester and continued progress on these issues.

Sincerely,

Ira Leighton
Acting Director
Office of Environmental Stewardship

cc: Gretchen Rule - NH DES
Charlie Hirshberg - NH DES
Gregg Comstock - NH DES
Tom Seigle - Manchester

ENVIRONMENTAL PROTECTION AGENCY

IN THE MATTER OF	)	
	)	
THE CITY OF MANCHESTER NEW HAMPSHIRE NPDES No. NH0100447	)	FINDINGS
	)	AND
Proceedings under Section 309(a)(3) of the Clean Water Act, as amended, 33 U.S.C. §1319(a)(3)	)	COMPLIANCE ORDER
	)	Docket # 99-06

I. STATUTORY AUTHORITY

The following findings are made and ORDER issued pursuant to Section 309(a)(3) of the Clean Water Act, as amended (the "ACT"), 33 U.S.C. § 1319(a)(3). Section 309(a)(3) grants to the Administrator of the U.S. Environmental Protection Agency ("EPA") the authority to issue orders requiring persons to comply with Section 301, 302, 306, 307, 308, 318 and 405 of the Act and any permit condition or limitation implementing any of such sections in a National Pollutant Discharge Elimination System ("NPDES") permit issued under Section 402 of the Act, 33 U.S.C. § 1342. This authority has been delegated to EPA's Regional Administrators.

The Order herein is based on findings pursuant to Section 301 of the Act, 33 U.S.C. § 1311, and the conditions of NPDES Permit No. NH0100447. Pursuant to Section 309(a)(5)(A) of the Act, 33 U.S.C. § 1319(a)(5)(A), the Order provides a schedule for compliance which the Regional Administrator has determined to be reasonable.

II. DEFINITIONS

Unless otherwise defined herein, terms used in this Order shall have the meaning given to those terms in the Clean Water Act, 33 U.S.C. § 1251 et seq., the regulations promulgated thereunder at 40 C.F.R. § 401.11, and any applicable NPDES permit. For purposes of this Order, "NPDES Permits" means the City's NPDES Permit Number NH0100447 and all amendments or modifications thereto and renewals thereof as are applicable, federally-approved and in effect at the time.

III. FINDINGS

The Regional Administrator makes the following findings of fact:

1. The City of Manchester, New Hampshire (the "Permittee") is a municipality under Section 502(4) of the Act.

2. The Permittee is a person under Section 502(5) of the Act, 33 U.S.C. § 1362(5). The Permittee is the owner and operator of a wastewater treatment facility (the "WWTF") and 26 combined sewer overflow discharge points ("CSOs"), which are point sources as defined in Sections 502(14) of the Act, 33 U.S.C. §1362(6) and (12), to the Merrimack and Piscataquog Rivers. Both of these receiving waters are Class B waterways and navigable waters under Section 502(7) of the Act, 33 U.S.C. § 1362(7). The WWTF is a secondary treatment facility with a design capacity to treat and discharge an average daily flow of 34 mgd.

3. On September 28, 1990, the Permittee was reissued NPDES permit No. NH 0100447 (the "Permit") by the Director of the Water Management Division of EPA, Region I, under the authority given to the Administrator of EPA by Section 402 of the Clean Water Act, 33 U.S.C. § 1342. This authority has been delegated by the Administrator of EPA to the Regional

Administrator of EPA, Region I, who has in turn delegated this authority to the Director of the Water Management Division. The Permit became effective on October 28, 1990, was modified on May 25, 1993, and expired on September 28, 1995 but continues in full force and effect due to timely reapplication.

4. The Permit authorizes the Permittee to discharge pollutants from specific point sources from the combined sewer system (i.e. CSOs) to the Merrimack and Piscataquog Rivers provided the discharge(s) do not cause violations of State Water Quality Standards.

5. Section 301(a) of the Act, 33 U.S.C. § 1311(a), makes unlawful the discharge of pollutants to waters of the United States except in compliance with, among other things, the terms and conditions of an NPDES permit issued pursuant to Section 402 of the Act, 33 U.S.C. § 1342.

6. EPA finds that the Permittee submitted CSO monitoring data to EPA and the New Hampshire Department of Environmental Services ("NH DES") demonstrating that the water quality standards for E. coli bacteria were exceeded due to CSO discharges from the Permittee's combined sewer system (See: CDM LTCP (May 1995) Section 2.6 (page 2-26)).

7. EPA finds that the discharges of wastewater with bacteria that caused levels of bacteria to exceed State Water Quality Standards in the receiving water had occurred in violation of the Permit and Section 301(a) of the Act.

8. The Permittee makes no admission with respect to the matters alleged in Paragraphs Nos. 6 and 7 above.

IV. COMPLIANCE ORDER

Accordingly, pursuant to Section 309(a)(3) of the Clean Water Act, EPA hereby orders and the Permittee agrees, that it shall:

WWTF MODIFICATIONS TO ACCOMMODATE

WET WEATHER TREATMENT CAPACITY

1. Within 6 months of receipt of this Order, submit to EPA for review and to the NHDES for review and approval design plans for WWTF modifications to allow up to 50 mgd of wet weather flows to pass through the existing primary treatment facilities (grit removal, primary sedimentation, plus disinfection) and bypass the existing secondary treatment facilities (aeration and final clarification).

2. Within 12 months of approval of the plans and designs by NHDES, sufficient to preserve full eligibility for all available State and federal funding, complete bidding, obtain NHDES approval of award, execute contract and complete construction consistent with Paragraph 1 above.

LTCP PHASE I CSO ABATEMENT PROJECTS

3. Within 6 months of receipt of this Order, submit to EPA and the NHDES a collection system flow monitoring program plan for review and comment. The plan shall include a proposed implementation schedule. The purpose of the Flow Monitoring Program is to determine the effectiveness of the sewer separation projects listed in Paragraph 4 below in reducing CSO discharges, as well as to further characterize the overflows from the remaining CSOs.

4. Within 6 months of receipt of this Order, submit to EPA and the NHDES a schedule for the design and construction (include proposed tasks, and task completion dates) of each of the following LTCP Phase I Piscataquog River CSO abatement projects: Electric Street (#032) sewer separation; Theophile Street (#033) sewer separation; Sullivan Street (#034) sewer separation; Varney Street (#036) sewer separation; South Main (North) (#037) sewer separation; South Main (South) (#038) sewer separation; Third Street (#039) sewer separation; and West Hancock (#013) sewer separation. For each of these sewer separation projects, the Permittee shall submit to EPA and NHDES an engineering analysis that determines whether sanitary or storm lines are to be constructed for each.

5. Within five (5) years after receipt of this Order, submit to EPA and the NHDES a schedule for the design and construction (include proposed tasks, and task completion dates) of each of the following LTCP Phase I Merrimack River CSO Abatement Projects: West Bridge (#022) sewer separation; Bremer (#024) sewer separation; Schiller (#011) sewer separation; Victoria (#030) sewer separation; Crescent Road (#042) sewer separation; and Poor (#009) partial separation. For each of these sewer separation projects, the Permittee shall submit to EPA and NHDES an engineering analysis that determines whether sanitary or storm lines are to be constructed for each.

6. Within twelve (12) months after the Bremer Street (#024) and West Bridge Street (#022) separation projects are completed, complete modifications to raise Weir elevations at the Lorraine (#025) and Turner (#018) CSOs to reduce the frequency of discharges at these outfalls. Provide the EPA/NHDES with notification of the final weir modifications and estimated CSO reduction achieved.

7. Within ten (10) years after the issuance of this Order, complete the LTCP Phase I CSO abatement projects implementation.

8. Revisions, if any, to the Schedules described in Paragraphs Nos. 4 and 5 must be made in writing and agreed to in writing by both EPA (after consultation with NHDES) and the Permittee.

PHASE I CSO ABATEMENT SCHEDULES FOR DISCRETE TASKS

9. Upon the Permittee's receipt of EPA's written approval (after consultation with NHDES) of a schedule for the projects described in Order Paragraphs 4 and 5, the schedule(s) shall be deemed incorporated into this Order and enforceable hereunder. If there is any delay in the implementation or completion of those projects due to having to obtain Federal, State and/or local permits, the Force Majeure provisions of this Order shall apply if the requirements for Force Majeure are met. Revision to the schedules must be made in writing and agreed to in writing by EPA, after consultation with NHDES.

LTCP UPDATE AND PHASE II CSO ABATEMENT PROJECTS DETERMINATION

10. Within two (2) years after receipt of this Order, submit to EPA and NHDES a scope of work for a Cemetery Brook Basin (CSO #44) Study ("Study") for further evaluation of that CSO. This study will identify and characterize the flow patterns and quantities within the basin, and evaluate the alternate control options available in the basin in order to determine cost-effective CSO control solutions. One of the alternatives for control of CSOs in the Cemetery Brook Basin is the use of swirl concentrator technologies. The study will include a

determination of the need to implement a pilot or demonstration project for evaluation of this technology as well as any other alternative technology that is appropriate and cost effective.

11. Within five (5) years after issuance of this Order, complete the Cemetery Brook Basin Study in accordance with the scope of work submitted to EPA and NHDES.

12. If it is determined through the Study that pilot testing of treatment technologies is required for the Cemetery Brook Basin, within 1 (one) year after the Permittee's receipt of EPA's and NHDES's written approval of the Cemetery Brook Basin Study, submit to EPA and NHDES a scope of work for a Cemetery Brook Basin Pilot Testing Project ("Pilot Project"). The Pilot Project, if required, will include the construction, operation and data gathering for the technologies being evaluated in accordance with the scope of work for the Pilot Project. The objective of the Pilot Project, if required, will be to determine the effectiveness of the technologies to adequately treat CSOs.

13. If recommended by the Study described above, within 4 (four) years after the Permittee's receipt of EPA's and NHDES's written approval of the scope of work for the Pilot Project, complete the Pilot Project.

14. Within eleven (11) years after receipt of this Order, submit to EPA and NHDES a revised LTCP for CSO abatement. The revised plan shall evaluate the effectiveness of the Phase I LTCP projects, include an updated alternatives analysis for each of the remaining CSOs (Cemetery Brook, Lorraine Street, Turner Street, Stark Brook, Penacook Street, Bridge Street, Granite Street, Poor Street, Tannery Brook, WWTF MH#1, West Side Pump Station Emergency Outlet, WWTF MH#2, and Walnut/North Streets/Canal/W. Penacook Street), a financial capability analysis, and recommend Phase II CSO abatement projects and a proposed

3/15/10

implementation schedule (including completion dates). The revised LTCP shall be designed to comply with the requirements of the Clean Water Act and State and Federal CSO policies. In preparing the revised LTCP, EPA and the Permittee shall work together with NHDES to determine the appropriateness at that time of a water quality standard variance, redesignation of uses or adoption of temporary partial uses in addition to taking into consideration any changes in the law, and\or State and Federal CSO policies.

$5.6 MILLION SUPPLEMENTAL ENVIRONMENTAL PROJECTS PROGRAM

15. Pursuant to Section 309 of the Act, 33 U.S.C. §1319, as amended, within five (5) years after issuance of this Order, the Permittee shall complete implementation of the Supplemental Environmental Projects Program ("SEPP") in accordance with the provisions of Attachment 1 which is attached hereto and a part hereof. If there is any delay in the implementation or completion of the SEPP projects due to having to obtain Federal, State and/or local permits, the Force Majeure provisions of this Order apply if the requirements for Force Majeure are met. EPA shall not require Manchester to expend more than $5.6M total on the SEPP. The SEPP activities are as follows: Storm Water Control; Land Preservation; Stream Bank Stabilization and Erosion Control Along the Merrimack River and Tributaries; Restoration of Urban Ponds; Environmental Education and Volunteer Monitoring; and Reduction of Childhood Lead Poisoning and Asthma Prevention. Any and all changes or substitutions for these activities listed above must be mutually agreed to in accordance with the procedures set forth in Attachment 1. Any substitutions for the activities listed above, once approved in

accordance with the procedures set forth in Attachment 1, will be deemed incorporated into this Order.

SEMI-ANNUAL PROGRESS REPORTS AND WORK PROJECTIONS

16. Progress reports on CSO abatement projects implementation shall be submitted to EPA and the NHDES by January 15 and July 15 each year. The report shall describe the work performed during the previous 6 months and include a projection of the work to be performed during the next 6 month period. The feasibility of raising the weirs at the Lorraine (#025) and Turner (#018) CSOs as an interim CSO reduction project shall be evaluated. The Lorraine (#025) and Turner (#18) CSO projects shall be implemented as soon as practicable given the combined sewer system hydraulics.

WWTF WET WEATHER MONITORING AND REPORTING REQUIREMENTS

17. Interim CSO Related Bypass - Current Conditions

a. During wet weather events, the Permittee shall process as much flow through the WWTF as practicable. Prior to initiating a bypass, the flow through the secondary treatment facilities (aeration and final clarification), shall be maximized. The maximum secondary treatment flow is defined as approximately 1.7 times the average daily dry weather flow. Once WWTF modifications are completed as discussed in Paragraphs 1 and 2, the Permittee shall provide primary treatment to the practical limit of the primary facilities (grit removal and primary sedimentation) of 85 mgd under normal operating conditions. Until such time as the Permittee has

completed the requirements of Paragraphs 1 and 2, a total of approximately 50-60 mgd will be processed in accordance with the terms of this Paragraph 17a (unless prohibited by equipment related issues). The Permittee shall submit a high flow management plan with the design of the WWTF modifications described in Paragraph 1.

b. While this "CSO related bypass" is occurring, the flows receiving secondary treatment shall achieve the Permittee's NPDES effluent limitations. The Permittee is not required to use BOD and TSS data from days with CSO related bypass events when calculating average monthly percent removal of these pollutants. During CSO related bypass events, the blended final effluent shall achieve the E. coli, pH and total chlorine residual limits as set forth in the Permittee's then current NPDES permit and the monitoring and reporting requirements detailed in Attachment 2. Should the statutory or regulatory E. coli bacteria limit applicable to this type of discharge change, the Permittee shall be required to meet the then current E. coli bacteria limit. When the CSO related bypass is not active, the facility shall achieve all the Permit effluent limitations.

V. NOTIFICATION PROCEDURES

1. Where this Order requires a specific action to be performed within a certain time frame, the Permittee shall submit a written notice of compliance or noncompliance to EPA and NH DES with each deadline. Notification must be mailed within twenty-one (21) days after each

required deadline. The timely submission of a required report shall satisfy the requirement that a notice of compliance be submitted.

2. If noncompliance is reported, whether due to a Force Majeure event as addressed in Section VI of this Order or otherwise, notification should include the following information:

a. A description of the noncompliance;

b. A description of any actions taken or proposed by the Permittee to comply with the elapsed schedule requirements;

c. A description of any factors which tend to explain or mitigate the noncompliance;

d. An approximate date by which the Permittee will perform the required action.

3. Once the Permittee has returned to compliance, that compliance shall be reported by submitting any required documents or providing EPA and NH DES with a written report indicating that the required action has been achieved.

Submissions required by this Order shall be in writing and should be mailed to the following addresses:

Joy Palmer
U.S. Environmental Protection Agency-Region I
1 Congress St., Suite 1100 (SEW)
Boston, MA 02114

and

George Berlandi
New Hampshire Department of Environmental Services
Water Division
P.O. Box 95, 6 Hazen Drive
Concord, NH 03302-0095

VI. FORCE MAJEURE

1. The Permittee agrees that if the Permittee or any entity controlled by the Permittee, including its consultants, fails to comply with any provision of this Compliance Order, the Permittee shall notify EPA Region I and NHDES in writing, within 14 days of the Permittee learning of such noncompliance. This notice shall describe in detail:

   a. The reason for and anticipated length of time the noncompliance is expected to persist.

   b. The measures taken and to be taken by the Permittee to minimize the noncompliance.

   c. The timetable by which such measures will be implemented.

The Permittee shall adopt all reasonably feasible measures to avoid and minimize any noncompliance.

2. If EPA, in consultation with NHDES, agrees that the Permittee's failure or inability to comply with any provision of this Order has been or will be caused by circumstances beyond the control of and without the fault of the Permittee, including its consultants, and that the Permittee or any such entity controlled by the Permittee could not have reasonably foreseen and prevented such noncompliance, the Permittee shall in writing be excused as to the failure or inability to comply for the period of time the noncompliance or inability to comply continues due to the actual unavoidable delay resulting from such circumstances, not to exceed the amount of time lost due to the actual unavoidable delay resulting from such circumstances, or to the amount of time necessary to remove or resolve the inability to comply.

VII. MODIFICATION

Schedules and tasks specified in studies or plans approved by EPA under this Order may be modified by written agreement of the Permittee and EPA (after consultation with NHDES). There shall be no other modifications of this Order without the written approval of EPA (after consultation with NHDES) and the Permittee.

VIII. SEVERABILITY

It is the intent of the parties that the clauses in this Order are severable. If a Court of competent jurisdiction declares any provision to be unenforceable, the remaining provisions of this Order shall remain in full force and effect.

IX. GENERAL PROVISIONS

1. If EPA (after consultation with NHDES) believes the Permittee has violated any requirement of this Order, EPA shall provide the Permittee with notice of that alleged violation and with the opportunity to (1) discuss the alleged violation with EPA officials; (2) explain the circumstances surrounding the alleged violation; (3) provide EPA with any information which may help resolve the issue and/or otherwise demonstrate that an administrative action and/or imposition of penalties is not appropriate under the circumstances; and/or (4) present information supporting the applicability of the Force Majeure provisions of this Order. EPA shall send a copy of the notice to NHDES.

2. The Permittee may, if it desires, assert a business confidentiality claim covering part or all of the information requested in the manner described by 40 C.F.R. § 2.203(b).

Information covered by such a claim will be disclosed by EPA only to the extent, and by means of the procedures, set forth in 40 C.F.R. Part 2, Subpart B. If no such claim accompanies the information when it is received by EPA, the information may be made available to the public by EPA without further notice to the Permittee. The Permittee should read the above-cited regulations carefully before asserting a business confidentiality claim since certain categories of information are not properly the subject of such a claim. For example, the Clean Water Act provides that "effluent data" shall in all cases be made available to the public. See Section 308(b) of the Act, 33 U.S.C. § 1318(b).

3. This Order does not constitute a waiver or a modification of the terms and conditions of the Permit. The Permit remains in full force and effect, and EPA reserves the right to seek any and all available remedies for violations of that permit.

4. This Order shall become effective upon receipt by the Permittee.

5. The Permittee may request, and EPA will consider (in consultation with NHDES), a modification of this Order if subsequent to its issuance there is a significant change in the Clean Water Act or its implementing regulations and further implementation of the activities required by this Order would be contrary to such change.

X. TERMINATION

This Order shall terminate when the Permittee has completed the Phase I CSO abatement projects as provided for in this Order and otherwise complied with all aspects of this Order.

3/8/99
Date

John P. DeVillars
Regional Administrator
EPA-New England

3/5/99
Date

Raymond J. Wieczorak
Mayor
City of Manchester, NH

Attachment 1

Supplemental Environmental Projects Program

INTRODUCTION

The Supplemental Environmental Projects Program (SEPP) is a cooperative effort among the City of Manchester (the "City"), the New Hampshire Department of Environmental Services (NHDES), and the U.S. Environmental Protection Agency, Region I-New England (EPA), to provide environmental benefits to the people of Manchester in addition to the benefits to be gained from combined sewer overflow abatement. The City must fund and implement the SEPP in accordance with this agreement. An effort will be made by those involved to increase and leverage funding for individual projects through matching programs and coordination with established efforts by citizen groups, agencies and private interests. An executive committee, the SEPP Executive Committee, will monitor implementation of the program.

SEPP EXECUTIVE COMMITTEE

The SEPP Executive Committee will oversee program implementation and rate of expenditures. The SEPP Executive Committee will consist of the Mayor of the City of Manchester, the Commissioner of NHDES and the Regional Administrator of EPA Region I - New England. The SEPP Executive Committee will make decisions, including the approval of any changes to the SEPP, by a unanimous decision of its three members.

SEPP ADVISORY COMMITTEE

A SEPP Advisory Committee may advise the Executive Committee, comment on the work plan and assist at the request of the Executive Committee in the development of projects. The core membership of the SEPP Advisory Committee will consist of a representative of the City, EPA , NHDES, and the Manchester Conservation Commission. Other agencies and groups will be consulted for input as required by the core committee.

SEPP WORK PLAN

Within 180 days of the date of this Agreement, the City, with assistance from the NHDES and EPA, shall submit a detailed Work Plan for implementation of the SEPP to the EPA and NHDES. The Work Plan shall include sufficient detail to adequately describe the implementation of each of the Supplemental Environmental Projects (A-G) described below. EPA and NHDES may approve the Work Plan in whole or in part. Once approved by EPA and NHDES, the work plan may not be significantly modified without a unanimous decision of the SEPP Executive Committee.

STATUS REPORTS

Every six months after approval of the SEPP Work Plan, the City will submit to the EPA and NHDES a status report describing progress over the previous six months and activities expected over the next six months for all matters under this SEPP. This progress report will review environmental results and discuss the effectiveness of project activities.

SCHEDULE

The City must complete the SEPP within 5 (five) years of the date of this Agreement. Each individual SEPP project (A-G) described below will be completed in accordance with a schedule set forth in the SEPP Work Plan developed by the City and approved by the EPA and the NHDES. The land preservation project will be implemented as expeditiously as practicable.

SUPPLEMENTAL ENVIRONMENTAL PROJECTS

The City will spend $5.6 million over a five year period to implement projects (A-G) described below. The dollar amounts shown for each project are approximate. Actual circumstances during implementation, particularly in the preservation of the Atlantic White Cedar Swamp, may make it appropriate to reallocate funding among the respective projects, provided the total for all SEPP projects is $5.6 million. Such reallocation shall be approved by the Executive Committee.

A) Land Preservation - $2 million

The following sections (1-7) specify required measures to satisfy the land preservation requirements of this SEPP. Specifically, this document and a map titled "Hackett Hill Preserve and Development Plan" and dated February 26, 1999, describe the boundaries of the Atlantic White Cedar preserve on Hackett Hill and the management measures required in designated "sensitive development" areas. It is the goal of this agreement to preserve the integrity of the Atlantic White Cedar/Giant Rhododendron/Black Gum ecosystem in perpetuity while allowing for reasonable economic development on the balance of the property purchased

from The University of New Hampshire outside the Preserve so long as such development is otherwise permitted pursuant to applicable local, State and Federal law.

1. Land Acquisition Phasing

The Land Preservation project shall be implemented in phases as described below. If, during any phase of land acquisition the City reaches the $2M allotment for land preservation, the Executive Committee shall, within 30 days, decide whether to reallocate funds from other SEPP projects (B-G) to complete acquisition of the Preserve, which is the highest priority SEPP project.

Phase 1

The City shall acquire from the University of New Hampshire those lands delineated on the Preserve Map as areas P-1, D-1, D-2, D-3, D-4, D-5, D-6, and D-7.

Phase 2

The City shall convey to The Nature Conservancy (TNC) Preserve Map areas P-1a, P-1b, P-1c, and P-1d. This shall be counted as a credit, equal to the appraised value of the land, against the $2M the City is required to spend pursuant to Section 5 below. Until such time as those parcels are conveyed, the City shall hold those areas as undeveloped open space under the stewardship of the Manchester Conservation Commission.

Phase 3

If , after completing Phases 1-2, the City has not spent the total $2M allotted for the Land Preservation Project, or in the event the City has reached the $2M allotment, provided the Executive Committee agrees to reallocate funds from other SEPP projects, the City shall purchase and convey to The Nature Conservancy the Alliance Resources portion (Tax Map 766, Lot 4B) of the Additional Preserve Area (Preserve Map area P-2) consistent with Paragraph 3 below. If, after purchase of the Alliance Resources parcel, the City still has not exhausted the $2M allotment, or in the event the City has reached the $2M allotment, provided the Executive Committee agrees to reallocate funds from other SEPP projects, the City shall purchase and convey to The Nature Conservancy the Pichette portion (Tax Map 766, Lot 5) of the Additional Preserve Area consistent with Section 3 below.

Phase 4

To the extent the City has not expended $2M at the conclusion of Phases 1-3, or in the event the City has reached the $2M allotment, provided the Executive Committee agrees to reallocate funds from other SEPP projects, the City shall convey to the Nature Conservancy parcel P-1e.

Phase 5

The Preserve Map delineates a potential future development area in the northern portion of the preserve (area D-7). This area may be developed by the City only if an engineering analysis by the City shows the site to be developable. The site analysis shall delineate and buffer all vernal pools, and shall be reviewed by EPA and NHDES. If the engineering analysis determines the area to be unsuitable for development,

ownership of the potential future development area shall be conveyed to The Nature Conservancy provided the City has not reached the $2M allotment for land preservation, or in the event the City has reached the $2M allotment, provided the Executive Committee agrees to reallocate funds from other SEPP projects. If the $2M allotment for land preservation is reached, and the Executive Committee does not agree to allocate additional funds for land preservation, then rights of first refusal on the property shall be conveyed to the Nature Conservancy.

Phase 6

The City shall be permitted to sell and/or develop Preserve Map parcels D-1, D-2, D-3, D-4, D-5, D-6 and D-7 consistent with Phase 5 above and Section 4 below.

2. Preserve Boundary

The Preserve Map identifies a Preserve boundary, within which no development will take place and ownership with deeded rights of access will be conveyed to The Nature Conservancy within 2 years of the date of this Agreement, pursuant to Section 1 above. The TNC will be responsible for the stewardship of ecological resources within the Preserve. Limited trail development for educational purposes is allowed within the preserve. Motorized vehicles are prohibited.

3. Additional Preserve

The Preserve Map identifies an Additional Preserve Boundary (P-2). The City shall make a committed good faith effort to purchase the land within the Additional Preserve. For acquisition of the Additional Preserve lands, fee ownership or conservation easements conveyed to The Nature Conservancy are acceptable. If, upon completion of Phases 1-5 of the Land Preservation Project and within 2 years of the date of this Agreement, the $2M allocated for Land Preservation have not yet been exhausted, then the balance of funds allocated by this Agreement to Land Preservation shall be used for the purchase of ecologically significant lands in Manchester as approved by the Executive Committee.

4. Sensitive Development Areas

Four areas on the Preserve Map labeled "Sensitive Development" are within the watersheds of the Atlantic White Cedar Swamp and Black Gum communities. These areas are not included within the Preserve in recognition of the City's need for reasonable economic gain from disposition of the property. The hilltop area is served by roads and utilities and includes favorable development sites. Due to the potential for irreparable harm to the ecological integrity of the swamp complex from development in these areas, the following sensitive development measures are required for building sites within the Sensitive Development zone (these requirements will be implemented as deed restrictions and run with the land):

a) All drainage shall be either piped out of the watershed of the sensitive swamp complex or, if approved by NHDES and EPA, retained in such a manner as to mitigate impacts on the complex. All drainage structures, pumps, and piping shall be owned, operated, and maintained in perpetuity by the City of Manchester. Undisturbed areas

which receive no runoff from impervious areas may continue to drain within the watershed.

b) There shall be no salt applied to roadways and parking lots for winter road maintenance.

c) Designated snow storage areas shall be created for deposit of plowed snow. Such snow storage areas shall be designed to trap all sediment for collection and proper disposal.

d) All trash storage areas shall be covered and protected from the weather.

e) Roadways and parking lots shall be vacuum swept at least bi-weekly except as winter conditions may prohibit and shall otherwise be kept in a clean manner.

f) Existing parking lots shall only be used as parking lots, unless alternate site development configurations which minimize environmental and visual impacts are approved by the mutual consent of NHDES and EPA.

g) There shall be no cutting of trees outside of designated building sites except for routine maintenance of dead or overhanging limbs.

h) All development sites shall be actively managed to prevent contamination of sensitive areas. All lessees and landowners within the park shall be subject to annual property inspections by the City for the purpose of educating site operators about pollution prevention and the significance of the local ecological resources. NHDES staff shall be available to train inspectors. Inspections shall focus on stormwater management, parking lot maintenance, lighting, landscaping, herbicides, fertilizers, and storage of regulated substances. Copies of annual inspection reports shall be provided to EPA and NHDES.

G) Measuring Environmental Results

In an effort to measure and track improvements to the environment as a result of this SEPP the City will establish a series of practicable measures by which it can report change over time. These measures will be described in the work plan and reported in the status reports. The City will establish a baseline to measure from and is expected to take advantage of the assistance of volunteers to do some of this work as well as water quality sampling. Some of the measures that could be used include:

- Water quality parameters, such as: dissolved oxygen, nutrients, pH, bacteria, temperature, turbidity, metal and PAH's
- Number of illicit sewer connections removed
- Pounds of trash removed from the River in cleanups
- Percent of the total of the number of storm drains stenciled
- Acres of land protected
- Percent of riparian habitat improved
- Aquatic health based on presence and diversity of macro invertebrates
- Tons of sediment kept from getting to the river due to erosion controls

REASONABLE ENVIRONMENTAL CONSULTING COSTS

It is understood that the cost of reasonable environmental or engineering consultants required to facilitate compliance with the SEPP and the measurement of environmental results described in section G above will be considered as part of the total cost included in the $5.6 million. It is also understood that the City will make practical efforts to avail itself of available environmental or engineering assistance from federal and state agencies.

E) Reduce Environmental Health Risks to Children - $500,000

The City agrees to commit $50,000 per year for five years towards the establishment of an Environmental Toxicologist position for the Manchester Health Department and $50,000 per year for five years for environmental projects aimed at improving children's health as recommended by the United Way Healthy Manchester Coordinating Council. The Toxicologist will examine and recommend community strategies to address environmentally related health concerns in the community, with specific emphasis on childhood lead poisoning and asthma. Projects considered by the United Way Healthy Manchester Coordinating Council should likewise consider these two issues, although funds do not have to be spent exclusively on childhood lead poisoning and asthma. In addition, the Environmental Toxicologist will establish a mapping system for significant sources of pollution within the City and will work closely with local school and school nurses in the development of an asthma education project.

F) Environmental Education - $100,000

The City will consult with NHDES, EPA, NH Audubon, and the Merrimack River Watershed Council to develop and implement an environmental education program for seventh grade students and faculty to be run out of a City location such as Audubon's Manchester facilities at Amoskeag Falls and Lake Massabesic. This would include field trips and student involvement in environmental projects related to the SEPP.

i) All development, including buildings, parking lots, and utilities, shall be sited as far away from sensitive ecological resources as possible.

5. Cost Accounting

The City shall hire an independent appraiser, and NHDES and EPA shall also jointly hire an appraiser, to appraise the preserve land to be conveyed for purposes of determining the value of that land and the credit to be given to the City toward the $2M allotted for the land preservation projects. The City, EPA and NHDES agree that they shall provide both appraisers with all of the information they have relating to the subject property. If the two appraisals are within 15% of each other, they shall be averaged to determine the value and credit. If they are not within 15%, following an exchange of the two appraisals, the City, NHDES and EPA shall attempt to agree upon a stipulated value and credit toward the $2M. If, after 21 days, the parties are unable to agree, the City, NHDES and EPA shall jointly appoint a third appraiser who shall, after reviewing the tw appraisals, propose a stipulated value. The cost of this third appraisal will be split so that the City shall pay half and the EPA/NHDES shall pay half. The values of privately held lands acquired by the City (area P-2) shall be determined by independent appraisal.

6. Stewardship

The City shall match, up to $100,000, funds raised by public and private sources to endow The Nature Conservancy with a stewardship and education fund for the preserve. The City's contribution to the fund may be counted towards its commitment to land preservation under this SEPP.

7. Management

The City's Conservation Commission shall be consulted by The Nature Conservancy on any major policy or management issues dealing with the preserve areas. Parcels designated by the City for later transfer to The Nature Conservancy will be placed under the ownership of the City and management care of the Conservation Commission.

B) Storm Water control - $1 million

The City will develop a comprehensive program to control storm water. The storm water program should include, but not be limited to the following:

- Make all reasonable efforts to find and remove illicit sewer connections
- Implementation of a street sweeping/catch basin cleaning program
- Inventory of storm drains and adjacent land users to see if lands are available to act as catchment basins
- Clean up programs along the banks of Piscataquog River and other rivers, ponds and streams in the City
- Storm drain stenciling and outreach and education program to business and homeowners
- Good housekeeping measures for municipal operations
- Development of GIS for the drainage system

The City shall describe the methods used and the effectiveness of the measures listed above in enough detail to support an evaluation of the efforts. To the extent reasonably practicable, results should be presented in a fashion that will allow transfer of successful approaches to other cities and towns in New Hampshire and the Region.

C) Streambank Stabilization and Erosion Control - $1 million

The City will use up to $1 million to restore specified unstable or eroding banks along the Merrimack and its tributaries affecting water quality within the City of Manchester. River and stream banks shall be restored with a combination of structural devices and vegetation sufficient to hold the banks in place during normal flooding and ice scour events. The City shall use the list in Table C-1 and consult with the Natural Resources Conservation Service (NRCS) and the Army Corps of Engineers to identify locations yielding the most cost effective measures for erosion control actions resulting in improved water quality and protection of instream and riparian habitat. NRCS shall also be consulted for design assistance at individual sites. Site selection and designs shall be approved by the Executive Committee prior to construction. This effort shall include an educational program for students.

Table C-1 Description of Erosion Control Sites

Erosion Site Number	River	Description
1	Merrimack River (east bank)	Devon Street; bank erosion; 2000 foot length; 25 foot bank height; 1:1 slope; primary source of erosion is due to removal of forest buffer and urban runoff
2	Merrimack River (east bank)	Olmstead Ave.; gully erosion; 2 gullies; 5 to 10 feet in depth; 50 feet in length (each); primary source of erosion is due to removal of forest buffer and urban runoff
3	Merrimack River (east bank)	Hazelton Street; bank erosion; 300 foot length; 30 foot bank height; 1:1 slope; primary source of erosion is due to urban runoff and a residential area which is very close to the edge of the stream bank.

Erosion Site Number	River	Description
4	Merrimack River (east bank)	Riverdale Avenue; gully erosion; one gully; 100 foot length, 10 foot depth; 30 feet wide; primary source of erosion is due to street runoff
5	Merrimack River (west bank)	Daniel Webster Highway; bank erosion; 300 foot length, 12 foot bank height; primary source of erosion is due to the river undercutting the toe of the river bank and highway runoff
		Gully erosion; one gully; 50 foot length; 10 foot depth; primary source of erosion is due to highway runoff
6	Merrimack River (west bank)	Daniel Webster Highway; gully erosion; one gully; 70 foot length; 5 foot depth; primary source of erosion is due to highway runoff
7	Piscataquog River	Piscataquog River Park and Bass Island Parks; bank erosion; various lengths throughout the parks not greater than 25 to 50 feet in length; total length of approximately 300 feet; primary source of erosion is due to removal of forest buffer and urban runoff
8	Merrimack River (west bank)	Intervale Country Club; bank erosion; 2000 feet in length remains to be done (750 feet has already been stabilized by the country club); 12 foot bank height; 1:1 or less slope; primary cause of erosion is due to the removal of forest buffer and undercutting the toe of the slope

D) Restoration of Urban Ponds - $1 million

The City will use up to $1 million to improve the water quality and ecological integrity of urban ponds and wetland areas through removal of pollution sources and restoration of aquatic habitat. The Manchester Conservation Commission has identified the following areas for potential restoration:

- McQueston pond and wetland area
- Big and Little Cohas Brook
- Black Brook and Maxwell Pond
- Dorrs Pond and Ray Brook
- Crystal Lake
- Nutt Pond and Tannery Brook
- Stevens Pond and Cemetery Brook
- Pine Island Pond

The City shall develop a plan of action which would include an assessment of the ponds and recommendations for actions including: planning and engineering work, construction of best management practices, land use management and restoration actions. The plan of action shall be approved by the Executive Committee prior to commencement of work. This effort shall include an educational program for students.

We, the undersigned, hereby agree this 5th day of March 1999, to implement this Supplemental Environmental Projects Program.

Date: 3/8, 1999

John P. DeVillars
Regional Administrator
EPA Region I - New England

Date: 3/5, 1999

Robert W. Varney, Commissioner
New Hampshire Department of Environmental Services

Date: 3/5, 1999

Raymond J. Wieczorak
Mayor
City of Manchester, NH

Attachment 2

MONITORING REQUIREMENTS

During the period that the Consent Order is effective, the permittee is authorized to discharge from outfall serial number SUMA (blended discharge). Such discharges shall be limited and monitored as specified below. Such discharges may only occur under the conditions described in Order paragraph 17a.

EFFLUENT CHARACTERISTIC	DISCHARGE LIMITATIONS (SPECIFY UNITS)						MONITORING REQUIREMENTS[1,3,5]	
PARAMETER	AVERAGE MONTHLY[4]	AVERAGE WEEKLY[4]	MAXIMUM DAILY	AVERAGE MONTHLY[4]	AVERAGE WEEKLY[4]	MAXIMUM DAILY	MEASUREMENT FREQUENCY	SAMPLE TYPE
FLOW[5]	----------	----------	----------	----------	----------	REPORT	CONTINUOUS	RECORDER
BOD_5	REPORT (LBS/DAY)	REPORT (LBS/DAY)	----------	REPORT (mg/l)	REPORT (mg/l)	REPORT (mg/l)	1/BYPASS DAY	COMPOSITE
TSS	REPORT (LBS/DAY)	REPORT (LBS/DAY)	----------	REPORT (mg/l)	REPORT (mg/l)	REPORT (mg/l)	1/BYPASS DAY	COMPOSITE
pH[2]	SEE FOOTNOTE 4.						1/BYPASS EVENT /BYPASS DAY	GRAB
CHLORINE RESIDUAL[3]	----------	----------	----------	----------	----------	CURRENT PERMIT LIMIT	2/BYPASS EVENT /BYPASS DAY	GRAB
ESCHERICHIA COLI[3]	----------	----------	----------	----------	----------	CURRENT PERMIT LIMIT	1/BYPASS EVENT /BYPASS DAY	GRAB
OVERFLOW USE OCCURENCES	REPORT THE NUMBER OF BYPASS DAYS' AND THE NUMBER OF HOURS PER DAY THAT THE CSO RELATED BYPASS OCCURRED.						----------	-------

All samples shall be collected and tested using EPA approved methods as stated at 40 C.F.R. 136, unless otherwise defined in the permit.

Outfall serial number SUMA discharge data shall be submitted with monthly Discharge Monitoring Reports as specified by the NPDES Permit.

ATTACHMENT 2

FOOTNOTES

1) SAMPLING LOCATIONS:

Effluent sampling for NPDES compliance for BOD_5 and TSS, on each bypass day, shall be conducted after the secondary clarifiers and before the blend with the wet weather bypass. This sampling location is identified as sampler 8 and 9 at the WWTF.

Samples for total residual chlorine, pH and E. coli for NPDES compliance purposes, and on bypass days, will be taken after the last treatment process. This location is identified as sampler 10 at the WWTF.

On each bypass day, samples for BOD_5 and TSS will be taken for reporting purposes only at sampler 10, during the normal 24 hour reporting period, and an analysis will be done on the entire 24 hour composite. If no bypass occurs during this period, samples at sampler 10 will be taken and analyzed for BOD_5, TSS and other parameters specified in the Permittee's then current NPDES permit.

2) Samples for E. coli, pH and total residual chlorine will be done in accordance with the Permittee's then current NPDES permit. The City will ensure that the sample will be taken during at least one bypass event on each bypass day whenever practicable.

Bypass (self) monitoring data, to be collected and analyzed at Sampler 10 during bypass days/events, will be collected by the Permittee for up to two years after the receipt of the Order to establish baseline conditions. After two years, the EPA, NHDES and the City will meet to evaluate the data and determine if additional data collection is necessary.

3) A bypass event is defined as the period of time between the initiation of the bypass of secondary treatment and ceasing the bypass of secondary treatment. A bypass day is any portion of a calendar day in which a bypass event is occurring. A single bypass day may consist of multiple bypass events.

For bypass events exceeding one calendar day in duration, sampling shall be performed each day of the event according to the measurement frequency specified.

4) The pH of the effluent shall not be less than 6.0 nor greater than 8.5 at anytime, unless these values are exceeded due to natural causes or as a result of the approved treatment process.

5) The Permittee shall submit to EPA copies of all self monitoring data required by the New Hampshire Department of Environmental Services as reported on Monthly Operations Reports sheets.

6) The Permittee shall report bypass flow, secondary flow and total flow.

7) The Permittee shall report average monthly and average weekly BOD and TSS concentrations and mass loadings using all data (wet and dry) from Sampler 10 located downstream of all WWTF treatment processes. This report shall not be used for NPDES compliance purposes.

Appendix B

Appendix B

Semi-Annual Progress Report and Bypass Report
(January 1, 2009 to June 30, 2009)

Kevin A. Sheppard, P.E.
Public Works Director

Timothy J. Clougherty
Deputy Public Works Director

Frederick J. McNeill, P.E.
Chief Engineer

CITY OF MANCHESTER
Highway Department
Environmental Protection Division

July 16, 2009
No. 09-113

Ms. Joy Hilton
USEPA – Region 1
One Congress Street, Suite 1100 (SEW)
Boston, Massachusetts 02114

Mr. Stergios Spanos, P.E.
NH Department of Environmental Services
P.O. Box 95
Concord, New Hampshire 03302-0095

Subject: City of Manchester, New Hampshire
CSO Compliance Order Reports #21

Dear Ms. Hilton & Mr. Spanos:

Please find attached the City of Manchester's semi-annual CSO Progress Report and Supplemental Projects Report as required under Paragraph 16 of the EPA's Compliance Order. The report summarizes the work completed over the following period:

- Report #21 - January 2009 through June 2009

Also included as an appendix to this report is a summary of the days the CSO bypass was in use during the reporting period.

If you have any questions regarding these reports, or require any additional information, please feel free to contact us at your convenience.

Very truly yours,

Frederick J. McNeill

Frederick J. McNeill, P.E.
Chief Engineer

cc (with attachments) :
Mr. Carl DeLoi (EPA)
Ms. Trish Garrigan (EPA)
Ms. Margaret Bastien (NHDES)
Mr. Eric William (NHDES)
Mr. Rick Cantu (EPD)
Mr. Robert Robinson (EPD)
Mr. Joe Laliberte (CDM)

City of Manchester Department of Highways
CSO Progress Report and Supplemental Projects Report
Period: January 2009 through July 2009

Compliance Order Item	Description	Due Date	Work Completed This Period	Work to Be Completed Next Period
WWTP Modifications to Accommodate Wet Weather Treatment Capacity				
1.	Submit design of WWTP modifications to EPA and NHDES.	9/15/99	▪ Compliance Order (CO) Item **Completed**	▪ CO Item **Completed**
2.	Complete bidding, award, and construction of WWTP modification.	Within 12 months of approval of plans.	▪ CO Item **Completed**	▪ CO Item **Completed**. See Item 17a below.
LTCP Phase I CSO Abatement Projects				
3.	Submit flow monitoring program plan.	9/15/99	▪ CO Item **Completed**	▪ CO Item **Completed**
	Implement monitoring plan with minor modifications. Submit results as needed.		▪ Completed updating the SWMM model with Spring 2008 flow metering results on the west side and completed analysis ▪ Finalizing Phase I Summary Report, which includes results of flow metering/modeling on the west side ▪ Performed flow metering of remaining CSOs and interceptors on the East Side	▪ Complete and submit final Phase I Summary report for review ▪ Update the SWMM model with Spring 2009 flow metering results on the east side

Legend: Completed; Ongoing or to be Implemented

City of Manchester Department of Highways
CSO Progress Report and Supplemental Projects Report
Period: January 2009 through July 2009

	4	Submit schedule for the design and construction of each of the LTCP Phase I Piscataquog River CSO abatement projects:	9/15/99	▪ CO Item **Completed**	▪ CO Item **Completed**
	–	Piscataquog River CSOs Preliminary Design Report	12/31/2000	▪ CO Item **Completed**	▪ CO Item **Completed**
	–	Electric St. St. CSO – Design	8/1/2000	▪ CO Item **Completed**	▪ CO Item **Completed**
		Electric St. CSO – Construction	12/31/2002	▪ CO Item **Completed**	▪ CO **Item Completed**
	–	Theophile St. CSO – Design	8/1/2000	▪ CO Item **Completed**	▪ CO Item **Completed**
		Theophile St. CSO – Construction	12/31/2002	▪ CO Item **Completed**	▪ CO Item **Completed**
	–	Sullivan St. CSO – Design	7/1/2001	▪ CO Item **Completed**	▪ CO Item **Completed**
		Sullivan St. CSO – Construction	12/31/2004	▪ CO Item **Completed**	▪ CO Item **Completed**
	–	Varney St. CSO – Design	5/1/2002	▪ CO Item **Completed**	▪ CO Item **Completed**
		Varney St. CSO – Construction	12/31/2005	▪ CO Item **Completed**	▪ CO Item **Completed**
	–	S. Main St. (S) CSO – Design	5/1/2002	▪ CO Item **Completed**	▪ CO Item **Completed**
		S. Main St. (S) CSO– Construction	12/31/2005	▪ CO Item **Completed**	▪ CO Item **Completed**
	–	Third St. CSO – Design	5/1/2004	▪ CO Item Completed	▪ CO Item Completed
		Third St. CSO – Construction	12/31/2006	▪ Results of the Spring '08 flow metering/modeling were summarized in the draft Phase I Summary Report	▪ CO Item Completed ▪ Submit final Phase I Summary Report for review

Legend: Completed

Ongoing or to be Implemented

City of Manchester Department of Highways
CSO Progress Report and Supplemental Projects Report
Period: January 2009 through July 2009

	--	W. Hancock St. CSO – Design	5/1/2004	▪ CO Item **Completed**	▪ CO Item **Completed**
		W. Hancock St. CSO – Construction	12/31/2006	▪ CO Item **Completed**	▪ CO Item **Completed**
	--	S. Main St. (N) CSO – Design	5/1/2004	▪ CO Item **Completed**	▪ CO Item **Completed**
		S. Main St. (N) CSO – Construction	12/31/2007	▪ CO Item **Completed**	▪ CO Item **Completed**
	--	W. Bridge Street CSO – Design	5/1/2005	▪ CO Item **Completed**	▪ CO Item **Completed**
		W. Bridge Street CSO –Construction	12/31/2008	▪ CO Item **Completed**	▪ CO Item **Completed**
	--	Bremer Street CSO – Design	5/1/2005	▪ CO Item **Completed**	▪ CO Item **Completed**
		Bremer Street CSO –Construction	12/31/2008	▪ CO Item **Completed**	▪ CO Item **Completed**
	--	Poor Street CSO – Design	5/1/2006	▪ CO Item **Completed**	▪ CO Item **Completed**
		Poor Street CSO – Construction	12/31/2008	▪ CO Item **Completed**	▪ CO Item **Completed**
	--	Schiller Street CSO – Design	5/1/2006	▪ CO Item **Completed**	▪ CO Item **Completed**
		Schiller Street CSO – Construction	12/31/2008	▪ Results of the Spring '08 flow metering/modeling were summarized in the draft Phase I Summary Report	▪ CO Item Completed ▪ Complete and submit final Phase I Summary Report for review
	--	Victoria Street CSO – Design	5/1/2007	▪ CO Item **Completed**	▪ CO Item **Completed**
		Victoria Street CSO – Construction	12/31/2008	▪ CO Item **Completed**	▪ CO Item **Completed**
	--	Crescent Road CSO – Design	5/1/2006	▪ CO Item **Completed**	▪ CO Item **Completed**
		Crescent Road CSO – Construction	12/31/2008	▪ CO Item **Completed**	▪ CO Item **Completed**

Legend: Completed

Ongoing or to be Implemented

City of Manchester Department of Highways
CSO Progress Report and Supplemental Projects Report
Period: January 2009 through July 2009

	5.	Submit schedule for the design and construction of each of the LTCP Phase I Merrimack River CSO abatement projects.	3/15/04	▪ CO Item **Completed**	▪ CO Item **Completed**
	6.	Raise weir elevations at Lorraine Street CSO.	8/15/08	▪ CO Item **Completed**	▪ CO Item **Completed**
		Raise weir elevations at Turner Street CSO.	8/15/08	▪ Results of the Spring '08 flow metering/modeling were summarized in the draft Phase I Summary Report ▪ Completed design drawing to modify the CSO structure to reduce CSO discharges	▪ Complete and submit final Phase I Summary Report for review ▪ Perform modifications to the CSO structure to reduce CSO discharges
	7.	Complete LTCP Phase I CSO implementation.	3/15/09	▪ Ongoing	▪ Complete and submit final Phase I Summary Report for review
LTCP Update and Phase II CSO Abatement Projects Determination					
	10.	Submit scope of work for Cemetery Brook Basin Study.	3/15/01	▪ CO Item **Completed**	▪ CO Item **Completed**
	11.	Complete and submit Cemetery Brook Basin Study to EPA and NHDES.	3/15/04 (Revised) 3/14/2005	▪ CO Item **Completed**	▪ CO Item **Completed**
	12.	Submit to EPA and NHDES scope of work for Cemetery Brook Basin Pilot Testing Project (if pilot testing is required.)	Within one year of approval by EPA and NHDES of Cemetery Brook Basin Study.	▪ None, not required	▪ None, not required

Legend: Completed
Ongoing or to be Implemented

City of Manchester Department of Highways
CSO Progress Report and Supplemental Projects Report
Period: January 2009 through July 2009

	13.	Complete pilot project (if pilot testing is required.)	Within four years of by EPA/DES approval of Pilot Project scope.	▪ None, not required	▪ None, not required
	14.	Submit to EPA/NHDES revised LTCP for CSO abatement.	3/15/10	▪ Continued preparing summary report for Phase I CSO program ▪ Phase II LTCP underway. Completed flow metering, field investigations and began alternative analysis.	▪ Complete and submit final Phase I Summary Report for review ▪ Continue modeling, alternative analysis, and field investigations required to finalize Phase II LTCP
Supplemental Environmental Projects Program					
	15.	Submit detailed work plan for implementation of SEPP.	9/15/99	▪ CO Item **Completed**	▪ CO Item **Completed**
		Submit SEPP Status Report.	Every 6 months after approval of SEPP work plan.	▪ CO Item **Completed**	▪ CO Item **Completed**
		Implement SEPP Work Plan.	9/15/04 Requested extension to December 2006	▪ CO Item **Completed**	▪ CO Item **Completed**
		Land Preservation		▪ CO Item **Completed**	▪ CO Item **Completed**
		Health Risk		▪ CO Item **Completed**	▪ CO Item **Completed**
		Stormwater		▪ CO Item **Completed**	▪ CO Item **Completed** ▪ City working on future Stormwater Utility

Legend: Completed

Ongoing or to be Implemented

City of Manchester Department of Highways
CSO Progress Report and Supplemental Projects Report
Period: January 2009 through July 2009

15. Continued		Urban Pond		▪ CO Item **Completed** ▪ Continued water quality monitoring through State V-LAP Program	▪ CO Item **Completed** ▪ Watershed Management Plan for Nutts Pond is ongoing ▪ Water quality monitoring will be continued in the future
		Streambank		▪ CO Item **Completed**	▪ CO Item **Completed**
		Environmental Education		▪ CO Item **Completed**	▪ CO Item **Completed**
	16.	Submit progress reports and work projections by 1/15 and 7/15 of each year.	Every 6 months in January and July.	▪ Submitted 21st report herein.	▪ Submit next report
WWTF Wet Weather Monitoring and Reporting Requirements					
	17.	a. Permittee shall process as much flow through WWTF as practicable during wet weather events. Provide primary treatment to primary facilities. Submit high flow management plan.	-	▪ Modified process as agreed upon with NHDES and EPA, to process up to 50 mgd of wet weather flow but only 65 mgd of total flow during storm events.	▪ Continue to implement CSO treatment at WWTF to extent possible
		b. During CSO related bypass, flows receiving secondary treatment shall achieve NPDES permit limits.	-	▪ See attached monthly bypass reports.	▪ Operate within NPDES limits.

Legend: Completed
Ongoing or to be Implemented

CITY OF MANCHESTER

ENVIRONMENTAL PROTECTION DIVISION

BYPASS REPORT 2009

1-Jan

DATE	FLOW MGD	BYPASS TIME Hrs:Mins	BYPASS DAY VIOLATIONS BOD MG/L	TSS MG/L	COLIFORM CFU	PH SU

CITY OF MANCHESTER

ENVIRONMENTAL PROTECTION DIVISION

BYPASS REPORT Feb 2009

			BYPASS DAY VIOLATIONS			
DATE	FLOW MGD	BYPASS TIME Hrs:Mins	BOD MG/L	TSS MG/L	COLIFORM CFU	PH SU
12-Feb	1.25	2:00				
17-Feb	0.35	1:00				
19-Feb	3.79	8:00				
22-Feb	3.38	5:00				
23-Feb	0.85	2:00				
27-Feb	4.71	10:00				
28-Feb	2.54	12:00				
	16.87					

CITY OF MANCHESTER

ENVIRONMENTAL PROTECTION DIVISION

BYPASS REPORT MARCH 2009

DATE	FLOW MGD	BYPASS TIME Hrs:Mins	BYPASS DAY VIOLATIONS BOD MG/L	TSS MG/L	COLIFORM CFU	PH SU
1-Mar	0.38	4:00				
7-Mar	0.01	1:00				
8-Mar	0.6	1:00				
9-Mar	4.52	13:00				
10-Mar	2.41	15:00				
11-Mar	11.2	17:00				
12-Mar	6.86	23:59				
13-Mar	5.08	20:00				
14-Mar	2.88	15:00				
15-Mar	2.53	12:00				
16-Mar	3.94	13:00				
17-Mar	3.62	15:00				
18-Mar	3.1	14:00				
19-Mar	3.42	18:00				
20-Mar	3.24	12:00				
21-Mar	2.13	10:00				
22-Mar	0.72	3:00				
27-Mar	1.67	5:00				
29-Mar	5.1	9:00				
30-Mar	5.8	15:00				
	69.21					

CITY OF MANCHESTER

ENVIRONMENTAL PROTECTION DIVISION

BYPASS REPORT 2 2009

April

DATE	FLOW	BYPASS TIME	BYPASS DAY VIOLATIONS			
			BOD	TSS	COLIFORM	PH
	MGD	Hrs:Mins	MG/L	MG/L	CFU	SU
1-Apr	1.06	5:00				
2-Apr	1.09	5:00				
3-Apr	9.04	10:00				
4-Apr	2.82	13:00				
5-Apr	2.6	10:00				
6-Apr	9.98	12:00				
7-Apr	11.61	23:00				
8-Apr	4.95	20:00				
9-Apr	3	14:00				
10-Apr	2.71	11:00				
11-Apr	0.96	4:00				
21-Apr	14.47	16:00				
22-Apr	8.5	15:00				
23-Apr	2.55	7:00				
24-Apr	4.93	11:00				
25-Apr	5.41	16:00				
26-Apr	1.73	10:00				
27-Apr	0.3	2:00				
	87.71					

CITY OF MANCHESTER

ENVIRONMENTAL PROTECTION DIVISION

BYPASS REPORT 2009

MAY

DATE	FLOW	BYPASS TIME	BYPASS DAY VIOLATIONS			
			BOD	TSS	COLIFORM	PH
	MGD	Hrs:Mins	MG/L	MG/L	CFU	SU
5-May	1.91	4:00				
6-May	4.09	7:00				
7-May	9.44	10:00				
9-May	3.62	3:00				
10-May	0.76	1:00				
27-May	7.31	9:00				

27.13

CITY OF MANCHESTER

ENVIRONMENTAL PROTECTION DIVISION

BYPASS REPORT JUNE 2009

			BYPASS DAY VIOLATIONS			
DATE	FLOW	BYPASS TIME	BOD	TSS	COLIFORM	PH
	MGD	Hrs:Mins	MG/L	MG/L	CFU	SU
9-Jun	1.16	2:00				
12-Jun	12.63	12:00				
13-Jun	0.53	1:00				
14-Jun	24.19	23:59				
15-Jun	5.42	12:00				
18-Jun	1.85	4:00				
19-Jun	9.47	16:00				
22-Jun	0.37	2:00				
24-Jun	3.62	8:00				
26-Jun	2.82	4:00				
28-Jun	2.02	3:00				
29-Jun	8.66	14:00				
30-Jun	13	23:59				
	85.74					

Appendix C

Appendix C

Original Collection System Flow Monitoring Program Plan (1999)

CDM Camp Dresser & McKee

Report

Manchester, NH
Department of Highways

Collection System Flow Monitoring Program Plan

September 1999

Manchester, New Hampshire
Collection System Flow Monitoring Program Plan

Purpose

On March 15, 1999, the City of Manchester and the Environmental Protection Agency (USEPA) entered into a Compliance Order (Order) for the implementation of a Long-Term Control Plan (LTCP) to control the City's Combined Sewer Overflow (CSO) discharges. This Order brings Manchester into compliance with the 1994 USEPA CSO Control Policy, the City's current National Pollutant Discharge Elimination System (NPDES) permit, and New Hampshire Water Quality Standards. To eliminate or reduce CSO discharges to the Piscataquog and Merrimack Rivers, the Order established a two-phase schedule.

Phase I will be implemented over an eleven (11) year period and will be completed on March 15, 2010 when the City must submit its updated LTCP for Phase II. For Phase I, Manchester is required to develop and implement a Collection System Flow Monitoring Program Plan for the combined sewer system and CSOs. This Plan summarizes the proposed Flow Monitoring Program that will be implemented by the City.

The purpose of the Flow Monitoring Program is to determine the effectiveness of the Phase I LTCP projects in reducing discharges from Manchester's CSO outfalls as well as to further characterize overflows from the remaining CSOs. This flow data will be used to develop the Phase II Long-Term CSO Control Plan for the City.

Plan Development

Overview

The City characterized the existing CSOs through the preparation of the 1993 CSO Baseline Conditions Report and the 1995 Long-Term CSO Control Plan. Accordingly, long-term flow monitoring is needed only at the interceptor system locations and CSO regulator/outfalls that will be impacted by the implementation of the Phase I LTCP. Estimations of CSO flows and activation frequencies for the CSOs that are unimproved by the Phase I plan can be determined from existing baseline conditions. Table 1 summarizes the status of each CSO after Phase I is implemented.

The recommended plan involves complete sewer separation of eight (8) CSO drainage areas along the Piscataquog River that will eliminate eight (8) existing outfalls and their need to be monitored. In addition, separation work will eliminate five (5) outfalls on the Merrimack River. This leaves thirteen (13) CSOs remaining that may need some level of monitoring (partial sewer separtion of the Poor Street CSO basin will be completed in Phase I, but may not eliminate discharges from this basin).

CSO Facility	Recommended CSO Abatement Measure	Resulting CSO Control
Piscataquog River CSOs		
Electric Street	Separation	Eliminated
Theophile Street	Separation	Eliminated
Sullivan Street	Separation	Eliminated
Varney Street	Separation	Eliminated
S. Main Street (N)	Separation	Eliminated
S. Main Street (S)	Separation	Eliminated
Third Street	Separation	Eliminated
W. Hancock Street	Separation	Eliminated
West Side Pumping Station	upstream sewer separation	Reduced Discharges[1]
Merrimack River (Northwest) CSOs		
Lorraine Street [2]	Raise Weirs	Reduced Discharges
Bremer Street	Separation	Eliminated
W. Bridge Street	Separation	Eliminated
Turner Street [2]	Raise Weirs	Reduced Discharges
Merrimack River (Southwest) CSOs		
Poor Street [2]	Partial Sep.	Reduced Discharges
Schiller Street	Separation	Eliminated
Merrimack River (Northeast) CSOs		
Stark Brook	-	-
Victoria Street	Separation	Eliminated
Pennacook Street	-	-
Merrimack River (Southeast) CSOs		
Bridge Street	--	--
Granite Street	--	--
Cemetery Brook	--	--
Tannery Brook	--	--
Crescent Road	Separation	Eliminated
WWTP Manholes #1/#2	WWTP Modifications	Reduced Discharges

NOTE: (1) CSO Discharges from the West Side P.S. should be significantly reduced, if not eliminated, by the Phase I Sewer Separation Projects.

(2) CSO Discharges at the Lorraine Street, Turner Street and Poor Street CSO outfalls will be reduced by the sewer separation and weir modifications proposed in Phase I.

Table 1
Phase I LTCP CSO Regulator Results

Monitoring Devices

Two equipment options were considered for flow measurement. The first option would utilize ultrasonic devices that can measure the depth of flow in the invert of the pipe. Ultrasonic gauges are installed in existing manholes or vaults and measure down to the water surface without a device in the flow stream. The second option would utilize a flow measuring device using depth and velocity sensors. The depth/velocity flow measuring equipment is installed in manholes or vaults, but requires that the sensors be installed in the flow stream. This increases maintenance requirements as the submerged sensor must be free of debris to collect accurate data.

Generally, depth-only measuring devices are less expensive to install and operate. However, data collected from depth-only gauges is less accurate and may not completely characterize flow conditions because of turbulent flow and backwater effects that occur during system surcharges (which can occur frequently in a combined system during wet weather events).

On-site data loggers will be used to record flow data that will be downloaded during regular field visits.

Field Inspections

Camp Dresser and McKee Inc. (CDM) and Utility Pipeline Services (UPS) conducted field inspections of the CSO regulators to consider the feasibility of using either depth-only or depth/velocity gauging devices at each regulator location. At many locations, surcharging in the sewer lines could result in less accurate flow recordings due to backwater or turbulent flow conditions during high flow (wet weather) conditions. More reliable data collection is recommended for this program as most of the data will eventually be used to formulate the Phase II CSO Plan. Thus, based on the field inspections, we determined that devices measuring both depth and velocity would be used for the City's monitoring program.

Long-Term Flow Monitoring Program

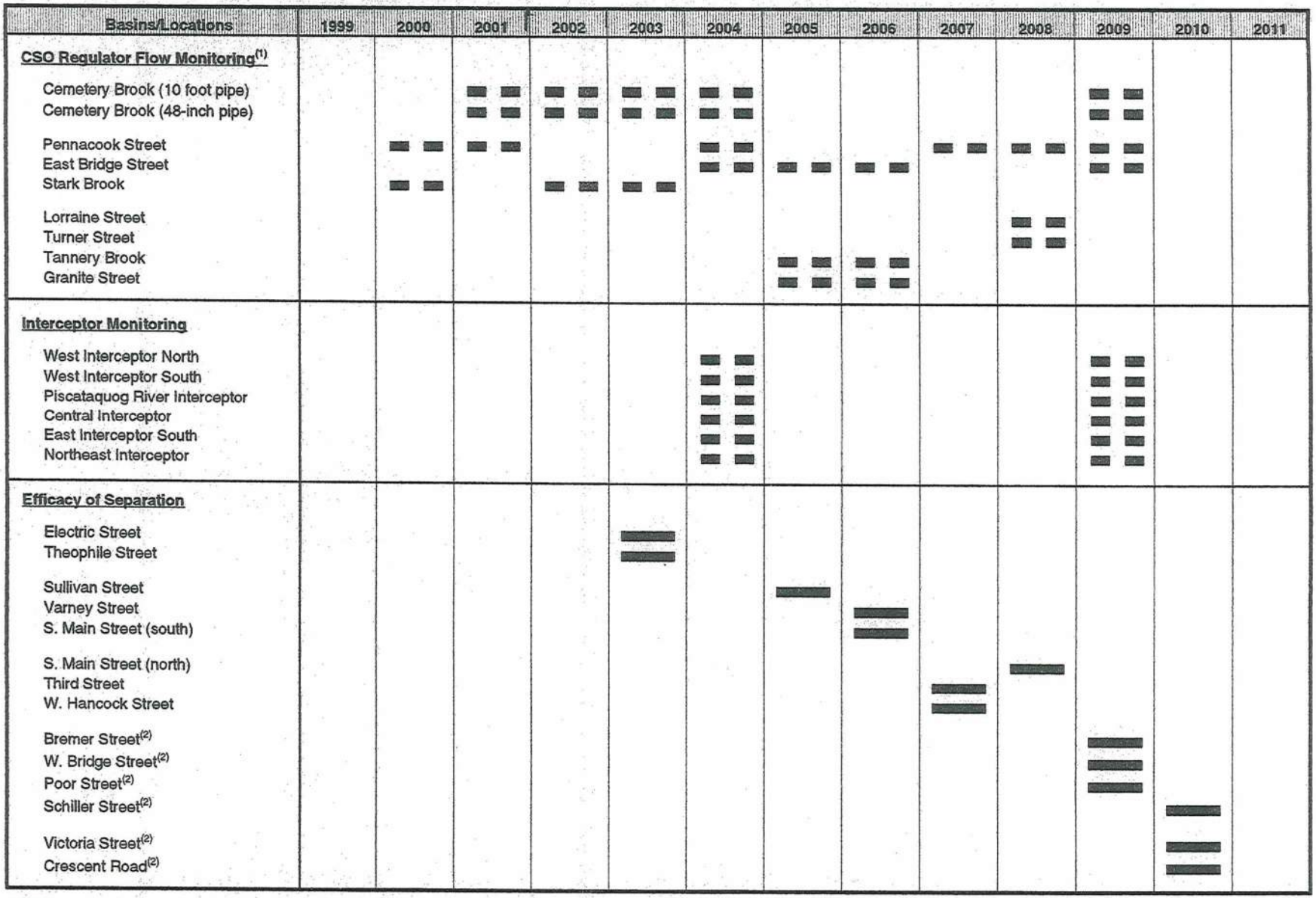
To address the compliance requirements and to collect the data to support the City's decisions in the Phase II CSO LTCP projects, the monitoring program will be implemented to achieve three goals:

- Monitor key CSO regulators as part of a long term monitoring program that can be used to select cost-effective Phase II CSO mitigation measures
- Monitor the combined sewer interceptor system to determine the effect of sewer separation of the Phase I CSO drainage basins and any flow changes in the overall system
- Monitor former CSO drainage basins after Phase I sewer separation projects have been completed to determine the efficacy of separation

Table 2 summarizes the flow monitoring program and Figure 1 shows the monitoring schedule.

Basins/Locations	Description of Program	Parameters Monitored
CSO Regulator Flow Monitoring Cemetery Brook (10 foot pipe) Cemetery Brook (48-inch pipe) Pennacook Street East Bridge Street Stark Brook (at Elgin Ave.) Lorraine Street Turner Street Tannery Brook Granite Street	Up to four (4) gauges will be used on a rotating basis to verify CSO outfall characteristics for reporting and efficacy assessment needs. The guages will be installed for two-12 week periods (spring and fall) for each gauging location.	Flow velocity and depth sensors in the influent and dry weather connector pipe (effluent to interceptor) for each CSO regulator
Interceptor Monitoring West Interceptor North West Interceptor South Piscataquog River Interceptor Central Interceptor East Interceptor South Northeast Interceptor	Once every five years, the interceptor system will be monitored for flow for two 12 week periods - once in the spring and fall. Six gauges will be installed for this program.	Depth and velocity at the manhole
Efficacy of Separation Electric Street Theophile Street Sullivan Street Varney Street S. Main Street (north) S. Main Street (south) Third Street W. Hancock Street Bremer Street W. Bridge Street Poor Street Schiller Street Victoria Street Crescent Road	Flow monitoring devices will be rotated to each CSO regulator as required to determine the efficacy of separation. Each monitoring will be installed for eight months of the monitoring period. Up to three (3) gauges may be installed in the field during any one year for this program.	Flow velocity and depth sensors in the influent and dry weather connector pipe (effluent to interceptor) for each CSO regulator

Table 2
Summary of Gauging Requirements



NOTE:

(1) CSO Regulator Monitoring Schedule is approximate. Monitoring locations may be adjusted as the program is implemented.

(2) Schedule for separation efficacy monitoring for the Merrimack River CSOs is proposed and subject to the future development of the implementation schedule for these CSOs in Phase I.

Figure 1
Proposed Monitoring Schedule

CSO Regulator Monitoring

Flow monitoring will be performed during the Phase I Program at the CSO regulators designated for future consideration under the Phase II CSO Program. This flow data will be used to develop the Phase II Program. Flow monitoring devices will be installed on a rotating basis (for a 12-week spring and a 12-week fall monitoring period) during Phase I as shown in Table 2 and Figure 1.

The flow monitoring locations identified for rotating flow equipment include:

- Cemetery Brook (2 regulators) (044)
- Pennacook Street (047)
- Bridge Street (046)
- Stark Brook (031)
- Lorraine Street (025)
- Turner Street (018)
- Tannery Brook (043)
- Granite Street (045)

Flow monitoring at Cemetery Brook location is proposed to coincide with the Cemetery Brook Basin Evaluation (required task under the Compliance Order) and the Interceptor Monitoring program (2004 and 2009). Monitoring of the Pennacook Street and East Bridge Street CSOs will also be coordinated with the Interceptor Monitoring program. Additional monitoring is also proposed at these two CSOs as time and funds permit to further evaluate wet weather conditions. Monitoring at the Lorraine Street and Turner Street CSOs will be coordinated with the completion of sewer separation projects for the Bremer Street and W. Bridge Street CSOs. Flow monitoring for the remaining CSOs (Stark Brook, Tannery Brook, and Granite Street) is proposed as a flexible program to collect further data on the wet weather response at these regulators. Additional monitoring is proposed at Stark Brook to evaluate the actual wet weather response of the drainage basin and Stark Brook, which ultimately enters the collection system.

Interceptor Monitoring

Flow monitoring of the City's interceptors will be performed to observe the effect of the upstream sewer separation projects, to quantify the CSO reduction achieved by reliable wet weather treatment at the City's wastewater treatment plant (WWTP) and at other key CSO regulators, and to establish a flow record of the collection system as the sanitary flow increases with growth. Once every five years, the interceptor will be monitored for flow for two(2) twelve-week periods, once in the spring and once in the fall. The key locations proposed for the interceptor system monitoring include:

- West Interceptor North (at Cleveland Street)
- West Interceptor South (at Cleveland Street)
- Piscataquog River Interceptor (at Cleveland Street)
- Central Interceptor (downstream of Pennacook Street CSO)
- East Interceptor South (downstream of Cemetery Brook CSO)
- Northeast Interceptor (downstream of Victoria Street CSO)

The City will begin the interceptor flow monitoring program in 2004, when the WWTP modifications and two of the Phase I sewer separation projects have been completed.

Separation Efficacy Monitoring

Each CSO drainage basin will be monitored after each Phase I sewer separation projects have been completed to determine the efficacy of separation. There are fourteen (14) separation projects to be implemented over ten (10) years. Monitoring gauges will be installed for an eight (8) month period after each basin is separated to collect dry and wet weather data. The data will be used to ensure that there is no significant wet weather response in the separated sanitary piping system before the outfalls are disconnected from the sanitary system. The locations for the efficacy of separation monitoring include:

- Electric Street (032)
- Theophile Street (033)
- Sullivan Street (034)
- Varney Street (036)
- S. Main Street (North)(037)
- S. Main Street (South)(038)
- Third Street (039)
- W. Hancock Street (013)
- Bremer Street (024)
- W. Bridge Street (022)
- Poor Street (009) - partial separation
- Schiller Street (011)
- Victoria Street (030)
- Crescent Road (042)

Data Collection, Summary, and Evaluation

Data generated from this flow monitoring program will be downloaded during bimonthly maintenance visits. Quarterly reports will be prepared that will include daily, weekly, and monthly flow totals in tabular and graphical formats. Rainfall data from the WWTP precipitation gauge will be included in flow tables and hydrographs. This information will eventually be used in analyzing the flow conditions in the combined system.

Annual reports summarizing the flow data will be prepared and submitted to NHDES and USEPA.

Implementation Schedule

Figure 1 shows the implementation schedule developed for each of the three individual flow monitoring programs.

- CSO Regulator Monitoring. Flow measuring devices could be installed within six (6) months of approval of this plan. Figure 1 shows the proposed monitoring plan; monitoring locations may be adjusted as the Phase I program is implemented.

- Interceptor Monitoring. The interceptors will be monitored twice, in 2004 and 2009, after the WWTP modifications and two of the Phase I sewer separation projects are completed.

- Separation Efficacy Monitoring. Flow monitoring will occur in each specific drainage basin following sewer separation of that area. Figure 1 shows the approximate efficacy monitoring schedule for the Merrimack River CSO Separation projects as the implementation schedule for these projects has not yet been fully developed.

Appendix D

Appendix D

Modified Collection System Flow Monitoring Program Plan (2003)

Tom

File CSO Compliance Reports

City of Manchester
Department of Highways
Environmental Protection Division

300 Winston Street
Manchester, New Hampshire 03103-6826
(603) 624-6595 Fax (603) 628-6234

January 16, 2003
#03-011

Ms. Joy Hilton
USEPA - Region 1
One Congress Street – Suite 1100 (SEW)
Boston, MA 02114

Mr. George Berlandi, P.E.
NH Department of Environmental Services
P.O Box 95
Concord, NH 03302-0095

RE: Manchester, NH
Compliance Order No. 99-06
Modifications to the Collection System Flow Monitoring Program

Dear Ms. Hilton and Mr. Berlandi:

The purpose of this letter is to describe our current modifications to the City of Manchester's Collection System Flow Monitoring Program Plan and Schedule. This plan was originally submitted in September 1999 as required under the CSO Compliance Order to monitor the combined sewer overflow discharges and to measure the benefits achieved by the system improvements implemented under the Phase I Long-Term CSO Control Plan.
We have made changes to the proposed monitoring programs for Efficacy of Separation and the Interceptor Monitoring; and we want to update you on the current status of CSO Regulator Flow Monitoring.

Efficacy of Separation Flow Monitoring

This flow monitoring program was aimed at determining if there was any remaining wet weather flow response sewer separation improvements were completed in each respective CSO drainage basin. Any remaining wet weather flow at the flow gauge could indicate that additional work may be needed in the basin to remove other extraneous flows (i.e., sump pumps, yard drains, etc.).
The program originally called for monitoring gauges to be installed in the system for eight (8) months. The City applied this approach to the first basin separated, the Theophile Street CSO basin, and began monitoring in spring/summer 2001. The City found that adequate flow data was obtained in about six (6) weeks of monitoring. During those six weeks, the City found that there were several remaining sources of extraneous flow that required further investigations and efforts for removal of the flow. This was reported to the USEPA/NHDES in a memorandum (dated October 29, 2001) that was included with the January 2002 Semi-Annual Compliance Order Progress Report to the agencies.

Subsequently, the City developed and is currently implementing a Private Inflow Elimination Program that is intended to be closely coordinated with the Separation Efficacy Flow Monitoring Program. The program is intended to provide follow-up and financial assistance to private property owners to systematically ensure the removal of the extraneous inflow connections to the sewer system. However, so far, the removal of private inflow sources has been slow because there are few plumbing contractors that are willing to assist homeowners in completing the necessary modifications. The City is continuing to work hard to identify willing plumbers and coordinate their work with private homeowners.

Based on the City's experience and new Private Inflow Elimination Removal Program, the City has modified the Efficacy of Separation flow monitoring program to achieve the same results as follows:

- Following sewer separation, the City would assist property owners to identify the methods of inflow removal, financial assistance for the removal of inflow in residential homes, certification of the removal and program documentation. This work would be completed under the Private Inflow Elimination Program. It is expected that private inflow elimination may not be completed for up to 12-18 months after the basin has been separated.

- After inflow removal, flow monitoring in each separated former CSO basin would be conducted over a six (6) to eight (8) week period to determine if any extraneous flow remained.

- Follow-up to remove the extraneous sources of flow would be performed under the Private Inflow Elimination Program.

- Follow-up monitoring may be performed, if necessary, after the identified extraneous flow sources have been removed. Flow monitoring would be conducted for six to eight week, or longer if necessary, to ensure that most, if not all, extraneous flow is removed from the sewer system. The City acknowledges that some extraneous flow sources may not be cost-effective to remove and will address each of these situations on a case-by-case basis.

Accordingly, removal of inflow sources in each basin is likely to be an iterative process of flow monitoring and inflow identification and removal. The City expects to complete cost-effective inflow removal and flow monitoring in each basin within 2-3 years after the completion of sewer separation.

Interceptor Flow Monitoring

According to the attached schedule, flow monitoring along the interceptor system was originally planned for 2004. Currently, the City has separated and eliminated CSO outfalls for the Theophile Street, Electric Street, Sullivan Street, and Varney Street CSO basins. In addition, the City expects to eliminate the South Main Street South, West Hancock Street, Third Street, West Bridge Street and South Main Street North CSO outfalls by 2005. The City's progress is well ahead of the Compliance Order Implementation Schedule.

Accordingly, the City will delay the system-wide interceptor flow monitoring program until these West Side sewer separation projects are complete and the expected benefits of sewer separation in this part of the City can be more fully documented.

CSO Regulator Flow Monitoring

Significant flow monitoring was originally proposed for the Cemetery Brook, Pennacook Street and Stark Brook CSO Basins from 2000 to 2003. The intent of the flow monitoring was to update the characterization of the CSOs from each of these basins. Since the development of the Collection System Monitoring Program Plan, the City developed a scope of work and is currently conducting a comprehensive study of CSO alternatives for each of these drainage basins. The scope of work for this study was approved by the agencies. The report summarizing the study will be submitted to the agencies in Summer 2003.

The work in Pennacook Street and Cemetery Brook basins includes a comprehensive flow monitoring program (with more than 16 gauges over two eight-week monitoring seasons) and the development of separate hydraulic models of the combined sewer systems in each basin. The study in Stark Brook is focusing on sewer separation alternatives. Accordingly, the previous schedule for flow monitoring as proposed in Figure 1 (attached) has been supplanted by the new study of CSO alternatives in the Cemetery Brook, Pennacook Street and Stark Brook CSO basins.

The previous flow monitoring Schedule also calls for flow monitoring of the East Bridge Street Basin in 2004 and in other basins in 2005. Flow monitoring in these basin will be delayed by at least two years so that the City can focus on the comprehensive study of the basins above. Flow monitoring in other CSO basins may begin again in 2005 or 2006.

We trust that you will find these modifications to the Collection System Flow Monitoring Program to be satisfactory. Further adjustments to the proposed Collection System Monitoring schedule may be necessary in the future as the CSO program unfolds. Should you have any questions regarding the revised monitoring plan, please call me (603-624-6341).

Very truly yours,

Thomas W. Seigle, P.E.
Chief Sanitary Engineer

TWS/djv

Attach

cc Willie Vicens, CDM
Jim Drake, CDM

Appendix E

Appendix E

Status of Private Inflow Connections

City of Manchester, New Hampshire

Remaining Combined Sewer Inflow on West Side

Appendix E

West Interceptor North Sewer Area

West Interceptor North

Central Interceptor

Piscataquog River Interceptor

Yvette Street

Tondreau Court

West Interceptor North

Piscataquog River Interceptor Sewer Area

Turner/Ferry CSO Area

West Side Pump Station

Lewis Street

West Interceptor South

East Interceptor North

West Interceptor South Sewer Area

Merrimack River

Piscataquog River

500 250 0 500 1,000 1,500 Feet

Legend

- Combined Sewer Overflow
- Eliminated Combined Sewer Overflow
- Sanitary Interceptors
- Sanitary Interceptor Areas
- Remaining Combined Catchment Area
- Roof Not Conneted to Sewer OR Building in Phase II Area
- Flat Roof Connected to Sewer
- Flat Roof Leader Not Connected to Sewer
- Suspect Flat Roof Connection to Sewer

N W E S

CDM

Manchester, NH
Phase 1 CSO Summary Report
Private I/I Identification and Removal Program Summary

I) *Inflows Removed*

# Sump Pumps:	27
# Roof Drains:	99
# Yard Drains:	15
Total Removed:	**141**

II) Known *Inflow Connections w/ Drain Services Completed to Property Lines Only*

# Sump Pumps:	13
# Roof Drains:	99
# Yard Drains:	2
Total:	**114**

III) *Other Identified OR Suspected Inflow Connections*

# Identified Sump Pumps:	4
# Identified Roof Drains:	61
# Identified Yard Drains:	4
# Suspected Sump Pumps:	28
# Suspected Roof Drains:	204
# Suspected Yard Drains:	57
Estimated Total:	**358**

IV) *Total Remaining Identified and Suspected Inflows (II plus III)*

# Known/Suspected Sump Pumps:	45
# Known/Suspected Roof Drains:	364
# Known/Suspected Yard Drains:	63
Estimated Grand Total Remaining:	**472**

Manchester, NH
Phase 1 CSO Summary Report
Inflows Removed (I)

Address	Location Description	Type and Number of Inflows Removed			Date Removed
		Sump Pump	Roof Drain	Yard Drain	
CSO Separation Contract 001 - Theophile St					
48 Henriette St Apts	Apartments		1		8/26/2002
152 Rockland Ave	House	1			10/15/2002
CSO Separation Contract 002 - Electric & Sullivan Sts					
436/438 Amory St	House		1		10/12/2004
488 Amory St	House		1		11/9/2004
558 Amory St/5 Cumberland	House		1		12/13/2004
51 Boutwell St (American Legion)	Private Club			1	5/8/2001
5 Cumberland St	House		1		12/13/2004
43 Cumberland St	House		1		7/26/2004
165 Electric St	House			1	7/30/2003
181 Electric St	House	1		1	9/24/2007
193 Electric St	House	1			----
124 Joliette St (GSM)	Commercial		1		4/1/2004
241 Joliette St	House	1			
345 Kelley St (at GSM)	Jimmy's Pizza		1		----
MHRA Kelley Falls Apts	Apartments		17		3/21/2002
Brown School Apts	Apartments		1		6/29/1905
CSO Separation Contract 003 - Varney St					
29 Head St	House			1	4/15/2002
71 Worthley Rd	House	1			----
Spruce St Interceptor Replacement Project					
58 Massabesic St	Commercial		1		12/15/2003
CSO Separation Contract - South Main (South) & W. Hancock Sts					
83 McNeil St	House	1			5/26/2004
101 McNeil St	House	1	1		----
111 McNeil St	House	2	1		5/26/2004
Putnam St (CMC)	Hospital			2	----
320/322 N. Main St	House		1		----
146 Flaherty St	House		1		----
227/233 Notre Dame Ave	House		1		----
246 N. Main St	House		1		----
43 Hecker St (parcel says #39)	House		1		----
32 Shuyler St	House		1		----
85 S. Main St (7-11 Store)	Store		1	1	----
21 Winter St	House	1			----
39 Winter St	House	2	1		----
109 Winter St/154 Parker	House		1		----
191 Winter St	House	1			----

Manchester, NH
Phase 1 CSO Summary Report
Inflows Removed (I)

Address	Location Description	Type and Number of Inflows Removed			Date Removed
		Sump Pump	Roof Drain	Yard Drain	
139 Parker St	House		1		----
275 W. Hancock St	House			1	----
265 S. Main St	?	1	1		----
322 S. Main St	House		1		----
353 S. Main St	Commercial		1	1	----
432 S. Main St	Commercial		1		----
438 S. Main St	?		1		----
19/21 C St	House		1		----
75/77 C St	House		1		----
30 Prince St	House		1		----
203 Bowman St	House		1		----
6/8 Riddle St	House		1		----
108 Riddle St	House		1		----
109 Riddle St	House		1		----
118 Riddle St	House		1		----
188 Milford St	House		1		----
34 King St	House		1		----
54 George St	House		1		----
68 George St	House		1		----
17/19 Summerside St	House		1		----
321 Wheelock St	House		1		----
25 Hale St	House	1			----
403 Second St	House	1	1	1	----
CSO Separation Contract 004 - South Main (North), West Bridge & Victoria Sts					
Cartier St Condo. Complex	Condos			1	4/5/2005
79 Conant St	House		1		6/20/2006
170 Conant St	House		1		2/25/2005
233 Douglas St	House		1		7/7/2004
18 Dubuque St	House		1		4/1/2005
24/26 Dubuque St	House		1		5/27/2005
14/16 Gates St	House		1		5/10/2005
472 Granite St	Apartments		1		5/10/2005
86 Putnam St	House		1		5/10/2005
88 Putnam St (Chez-Nous Laundromat)	Laundromat		1		---
102/104/106/108 Putnam St	House		1		6/28/2005
West High School	School		2	3	7/20/2005
317 Rimmon St	House		1		7/13/2005
St Marie Church Gymnasium (281 Cartier St)	Gymnasium		3		6/8/2005
68 Sullivan St	House		1		3/31/2005
55/57/63 Sullivan St (202 Notre Dame Ave)	House		1		4/7/2005
Hse. # Cartier East Back Alley	House		1		3/30/2005

Manchester, NH
Phase 1 CSO Summary Report
Inflows Removed (I)

Address	Location Description	Type and Number of Inflows Removed			Date Removed
		Sump Pump	Roof Drain	Yard Drain	
CSO Separation Contract 005 - West Bridge, Lorraine & Bremer Sts					
77 Bremer St	House		1		10/26/06
535 Dubuque St	House		1		3/7/2007
541/543 Dubuque St	House		1		3/8/2007
546 Dubuque St	House		1		3/8/2007
553 Dubuque St	House		1		3/12/2007
578 Dubuque St	House		1		3/7/2007
136 Kelley St (Chez-Vachon)	Restaurant		1		5/8/2007
658/660 Rimmon St	House		1		3/12/2007
672/674 Rimmon St	House		1		3/5/2007
690/692 Rimmon St	House		1		3/12/2007
CSO Separation Contract - Poor & Schiller Sts					
(None)					
CSO Separation Contract 006 - Crescent & Third Sts					
Gossler Park Elem. School (75 Parkside Ave)	School		5		8/8/2007
Jewett Elementary School	School		4		8/7/2007
Notre Dame Ave (St Marie Church)	Church			1	5/14/2008
74 Bosse Ave	House	1			1/17/2008
261/263 Second St	House		1		12/2/2008
262/264 Second St	House		1		12/2/2008
Woodcrest Court					
220 Woodcrest Ct	House	1			1/18/2003
236 Woodcrest Ct	House	1			1/31/2003
252 Woodcrest Ct	House	1			12/19/2003
276 Woodcrest Ct	House	1			12/19/2003
323 Woodcrest Ct	House	1			5/18/2004
324 Woodcrest Ct	House	1			9/18/2004
341 Woodcrest Ct	House	1			11/14/2004
344 Woodcrest Ct	House	1			11/3/2004
385 Woodcrest Ct	House	1			1/5/2004
401 Woodcrest Ct	House	1			11/25/2003
	Totals:	**27**	**99**	**15**	

Manchester, NH
Phase 1 CSO Summary Report
Inflows Connections Completed to Property Line Only (II)

Address	Location Description	Type of Inflow Identified			Date Drain Connection Completed to Property Line	Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain		
CSO Separation Contract 001 - Theophile St						
48 Henriette St Apts	Apartments		2		----	
448 Rockland Ave	House	1			12/8/2000	Yes
CSO Separation Contract 002 - Electric & Sullivan Sts						
555/557 Amory St	House		1		5/10/2002	Yes
124 Joliette St (GSM)	Commercial		1			
CSO Separation Contract 003 - Varney St						
(None)						
CSO Separation Contract - South Main (South) & W. Hancock Sts						
89 Goffe St	House		1		----	----
403 Second St	House	1	1	1	----	----
CSO Separation Contract 004 - South Main (North), West Bridge & Victoria Sts						
320 Douglas St	Apartments			1	5/18/2004	Yes
233 Douglas St	Apartments		1		7/7/2004	No
236 Douglas St (Haru-Gari Apartments)	Apartments		1		7/12/2004	Yes
84 Conant St	Apartments		1		11/2/2004	Yes
164/166 Conant St	Apartments		1		11/9/2004	Yes
6 Notre Dame Ave (also #1 thru #7)	Apartments		1		10/8/2004	Yes
182 Notre Dame Ave	Apartments		1		9/16/2004	Yes
284 Notre Dame Ave	Apartments		1		11/23/2004	Yes
418 Notre Dame Ave (122 Amory St)	Apartments		1		4/5/2005	Yes
73 Clinton St	Apartments		1		10/1/2004	Yes
50/52 Dubuque St	Apartments		1		11/30/2004	Yes
370 Dubuque St	Apartments		1		4/6/2005	Yes
376 Dubuque St	Apartments		1		4/5/2005	Yes
355-361 Dubuque St	Apartments		1		4/6/2005	Yes
410 Dubuque St	Apartments		1		4/5/2005	Yes
352/354 Dubuque St	Apartments		1		4/5/2005	Yes
335 Dubuque St (143 Wayne St)	Apartments		1		4/6/2005	Yes
265 Dubuque St	Apartments		1		5/17/2005	Yes
273 Dubuque St	Apartments		1		5/17/2005	Yes
101-107 Putnam St	Apartments		1		5/17/2005	Yes
57/59 Gates St	Apartments		1		11/30/2004	Yes
48 Gates St	Apartments		1		11/30/2004	Yes
166 Cartier St	Apartments		1		4/8/2005	Yes
275 Cartier St	Apartments		1		4/29/2005	Yes
226/228 Cartier St	Apartments		1		5/4/2005	Yes
227 Cartier St	Apartments		1		5/4/2005	No
127-131 Amory St	Apartments		1		4/6/2005	Yes

Manchester, NH
Phase 1 CSO Summary Report
Inflows Connections Completed to Property Line Only (II)

Address	Location Description	Type of Inflow Identified			Date Drain Connection Completed to Property Line	Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain		
160-168 Amory St	Commercial		1		4/6/2005	Yes
169 Amory St/ 413/415 Dubuque St	Apartments		1		4/6/2005	No
311 Rimmon St	Apartments		1		4/18/2005	Yes
335/337 Rimmon St	Apartments		1		4/18/2005	Yes
343/345 Rimmon St/ 176 Wayne St	Apartments		1		4/18/2005	Yes
355 Rimmon St	Apartments		1		4/18/2005	Yes
413 Rimmon St	Apartments		1		5/23/2005	Yes
60/62 Quincy St	Apartments		1		12/6/2004	Yes
359/361 Hevey St	Apartments		1		4/29/2005	Yes
419/421 Hevey St	Apartments		1		5/19/2005	Yes
167-169 Wayne St/ 336 Dubuque St (Durette Photo Lab)	Commercial/ Apartments		1		4/18/2005	Yes
43 Sullivan St	Apartments		1		9/16/2004	Yes
78/80 Sullivan St	Apartments		1		4/11/2005	Yes
CSO Separation Contract 005 - West Bridge, Lorraine & Bremer Sts						
90 Bremer St	House		1		10/23/06	No
114/116 Bremer St	House		1		10/23/06	No
586 Dubuque St	House		1		12/8/06	No
570 Dubuque St	Apartments		1		12/13/06	Yes
562 Dubuque St	Apartments		1		12/13/06	Yes
561 Dubuque St	Apartments		1		12/13/06	Yes
567 Dubuque St	Apartments		1		12/18/06	Yes
742 Hevey St	House		1		9/5/06	No
508 Dubuque St/ 126-128 Kelley St	Apartments		1		5/1/07	Yes
155 Kelley St	House		1		4/26/07	No
165 Kelley St	Apartments		1		5/2/07	No
604 Montgomery St	House		1		5/30/07	No
595 Montgomery St	House		1		6/1/07	No
596 Montgomery St	House		1		6/1/07	No
588 Montgomery St	House		1		6/1/07	No
589 Montgomery St	House		1		6/1/07	No
576 Montgomery St	House		1		6/8/07	No
535/537 Montgomery St	House		1		6/13/07	No
546 Montgomery St	House		1		6/13/07	No
551/553 Montgomery St	House		1		6/13/07	No
562 Montgomery St	House		1		6/13/07	No
569 Montgomery St	House		1		6/13/07	No
558 Montgomery St	House		1		6/13/07	No
561 Montgomery St	House		1		6/13/07	No
11 Reed St	House		1		5/14/07	No
17 Reed St	House		1		5/15/07	No
25 Reed St	House		1		5/15/07	No

Manchester, NH
Phase 1 CSO Summary Report
Inflows Connections Completed to Property Line Only (II)

Address	Location Description	Type of Inflow Identified			Date Drain Connection Completed to Property Line	Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain		
35 Reed St	House		1		5/15/07	No
41/43 Reed St	House		1		5/15/07	No
47 Reed St	House		1		5/15/07	No
215 Reed St	House		1		5/24/07	No
235 Reed St	House	1			5/24/07	No
224 Reed St	House	1			5/25/07	No
225 Reed St	House	1			5/25/07	No
247 Reed St	House	1			5/25/07	No
256 Reed St	House	1			5/25/07	No
248 Reed St	House	1			5/25/07	No
255 Reed St	House	1			5/25/07	No
264 Reed St	House	1			5/29/07	No
709/711 Rimmon St	House		1		8/21/06	Yes
666/668 Rimmon St	House		1		8/24/06	Yes
624 Rimmon St	House		1		10/19/06	No
575 Rimmon St	Apartments		1		5/2/07	Yes
585/587 Rimmon St	Apartments		1		5/2/07	Yes
583 Rimmon St (593?)	Apartments		1		5/2/07	No
543 Rimmon St	Apartments		1		5/2/07	Yes
561 Rimmon St	Apartments		1		5/2/07	Yes
569 Rimmon St	Apartments		1		5/2/07	Yes
539 Rimmon St	House		1		5/2/07	No
578 Rimmon St	House		1		5/3/07	Yes
584 Rimmon St	House		1		5/3/07	Yes
592 Rimmon St	House		1		5/3/07	Yes
602/604 Rimmon St	House		1		5/3/07	Yes
610 Rimmon St	House		1		5/3/07	No
614/616 Rimmon St	House		1		5/3/07	Yes
615/617 Rimmon St	House		1		5/4/07	Yes
609/611 Rimmon St	House		1		5/4/07	Yes
601 Rimmon St	House		1		5/4/07	Yes
709/711 Rimmon St	House		1		3/12/2007	Yes
624 Rimmon St	House		1		3/1/2007	Yes
271 Youville St	House		1		3/13/07	No
CSO Separation Contract - Poor & Schiller Sts						
(None)						
CSO Separation Contract 006 - Crescent & Third Sts						
23 Bosse Ave	House	3			11/5/2007	Yes
45-49 Sagamore St	House		1		11/5/2007	Yes
640 Pine St	House		1		12/6/2007	Yes
191 Third St	House		1		6/5/2008	Yes
	Totals:	**13**	**99**	**2**		

Manchester, NH
Phase 1 CSO Summary Report
Identified Inflows and Suspected Illicit Inflow Connections (III)

Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
Other Identified Inflows:					
CSO Separation Contract - South Main (South) & W. Hancock Sts					
221 Blaine St	House		1		---
162 Frederick St	House	1			---
46 Milford St (Blake's Ice Cream)	Restaurant	1	1	1	---
76 N. Main St	House			1	---
101 S. Main St	House		1		---
507 S. Main St	House		1		---
403 Second St	House	1	1		---
99 Dartmouth St	Apartments			2	---
5 Wheelock Rd.	House		1		---
253 W. Hancock St	House		1		---
274 W. Hancock St	House		1		---
CSO Separation Contract 004 - South Main (North), West Bridge & Victoria Sts					
201 Cartier St	House		1		Yes
217 Cartier St	House		1		No
269 Cartier St	House		1		Yes
310/312 Cartier St	House		1		Yes
314 Cartier St	House		1		Yes
280/282 Conant St	House		1		Yes
38/40 Hevey St	House		1		Yes
41 Hevey St	House		1		Yes
200 McGregor St (St Mary's Bank)	Commercial	1	1		Yes
95 Notre Dame Ave	House		1		Yes
152 Notre Dame Ave	House		1		Yes
210 Notre Dame Ave	House		1		Yes
227 Notre Dame Ave	House		1		Yes
237/239 Notre Dame Ave	House		1		Yes
97 Sullivan St	House		1		No
142/144 Wayne St (323 Dubuque St)	House		1		Yes
CSO Separation Contract 005 - West Bridge, Lorraine & Bremer Sts					
135 Amory St	House		1		Yes
159 Amory St	House		1		Yes
225/227 Amory St	Apartments		1		Yes
444 Dubuque St	House		1		No
462 Dubuque St	House		1		Yes
469 Dubuque St	House		1		Yes
478 Dubuque St	House		1		No
485 Dubuque St	House		1		No
486 Dubuque St	House		1		Yes
489 Dubuque St	House		1		No
495 Dubuque St	House		1		No

Manchester, NH
Phase 1 CSO Summary Report
Identified Inflows and Suspected Illicit Inflow Connections (III)

Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
501 Dubuque St	House		1		No
330 Hevey St	House		1		Yes
375/377 Hevey St	House		1		Yes
385/387 Hevey St	House		1		No
412/414 Hevey St	House		1		Yes
422/424 Hevey St	House		1		Yes
446 Hevey St	House		1		Yes
481 Hevey St	House		1		No
494 Hevey St	House		1		Yes
517 Hevey St	House		1		No
562 Hevey St	House		1		Yes
570 Hevey St	House		1		No
583 Hevey St	House		1		No
742 Hevey St	House		1		Yes
383 Rimmon St	House		1		No
413 Rimmon St	House		1		No
416 Rimmon St	House		1		No
461 Rimmon St	House		1		No
465 Rimmon St	House		1		No
468 Rimmon St	House		1		No
475 Rimmon St	House		1		No
478/480 Rimmon St	House		1		No
503/505 Rimmon St	House		1		Yes
514 Rimmon St	House		1		Yes
593 Rimmon St	House		1		No
645 Rimmon St	House		1		Yes
	Totals:	**4**	**61**	**4**	

Manchester, NH
Phase 1 CSO Summary Report
Identified Inflows and Suspected Illicit Inflow Connections (III)

Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
Other Potential/Suspected Inflow Connections					
CSO Separation Contract 001 - Theophile St					
95 Tondreau Ct	House		1		---
Tondreau Ct	Public CB			1	---
Yvette St	Public CB			2	---
CSO Separation Contract 002 - Electric & Sullivan Sts					
Across from 281 Bartlett St	House			1	---
273/275 Bartlett St	House			1	---
291 Bartlett St	House		1		---
297 Bartlett St	House		1		---
305 Bartlett St	House		1		---
316 Bartlett St	House		1		---
140 Boutwell St	House			1	---
172 Boutwell St	House			1	---
212 Boutwell St	House		1		---
241 Boutwell St	House		1		---
243 Bremer St (245?)	House		1		---
25/27 Columbus St	House		1		---
44 Columbus St	House		1		---
11 Congress St	House		1		---
17 Congress St	House		1		---
39 Cumberland St	House		1		---
52 Cumberland St	House		1		---
11/13 Essex St	House		1		---
20 Essex St	House		1		---
24/26 Joliette St	House		1		---
34 Joliette St	House		1		---
38/40 Joliette St	House		1		---
63 Joliette St	House		1		---
72 Joliette St (332/336 Kelley St)	Commercial		1		---
78 Joliette St (342 Kelley St)	Commercial		1		---
107 Joliette St	House		1		---
111 Joliette St (GSM)	Commercial		1		---
161 Joliette St	House		1		---
169 Joliette St	House		1		---
170 Joliette St	House		1		---
226 Joliette St	House		1		---
33 Kearsarge St	House		1		---
83 Kearsarge St	House			1	---
339 Kelley St (Kelley Street Garage)	Commercial		1		---
340 Kelley St	House		1		---
375 Kelley St	House		1		---

Manchester, NH
Phase 1 CSO Summary Report
Identified Inflows and Suspected Illicit Inflow Connections (III)

Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
383 Kelley St	House		1		---
384/386 Kelley St	House		1		---
392 Kelley St	House		1		---
429/435 Kelley St	House		1		---
449 Kelley St	House		1		---
Bob's Auto on Kelley St	Commercial		1		---
176 Kimball St	House	1			---
265 Kimball St	House			1	---
111/113 Lafayette St	House		1		---
117/119/121 Lafayette St	House		1		---
161 Lafayette St	House		1		---
25 Laval St	House		1		---
56 Laval St	House		1		---
68 Laval St	House		1		---
158 Laval St	House		1		---
166 Moore St	House	1			---
222 Moore St	House	1			---
56 Morgan St	House		1	1	---
183 Morgan St	House	1			---
342/344 Thornton St	House		1		---
298 Thornton St	House		1		---
190/192 Thornton St	House		1		---
179/181 Thornton St	House		1	1	---
175 Thornton St	House			1	---
353 Wayne St	House		1		---
351 Wayne St	House		1		---
253 Whipple St (352 Wayne St)	House		1		---
CSO Separation Contract 003 - Varney St					
5 Alpine St	House			1	---
16 Avon St	Apartments		1		---
86 Bismark St	House			1	---
147 Bismark St	House			1	---
163 Bismark St	House			1	---
39 Brock St	House			1	---
49 Brock St	House			1	---
99 Donald St	House			1	---
248 Donald St	House			1	---
63 Head St	House	1			---
75 Head St	House	1			---
38 Leandre St	House			1	---
84 Leandre St	House			1	---
68 Mast Road	House		2		---
145 Mast Rd	House		1		---
176 Mast Rd	House		1		---
58 Precourt St	House			1	---
134 Precourt St	House		1		---

Manchester, NH
Phase 1 CSO Summary Report
Identified Inflows and Suspected Illicit Inflow Connections (III)

Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
126 Riddle St	House		1		---
6/8 Riddle St	House		1		---
79 Rochelle Ave	House	1			---
109 St Marie St	House		1		---
29 Tanglewood Ct	House			1	---
18 Rockland Ave	Business		1		---
CSO Separation Contract - South Main (South) & W. Hancock Sts					
65 A St	House		1		---
61/63 B St	House		1		---
41 Bowman St (Old Varney School)	School		3	3	---
Parker-Varney School	School		3	3	---
203 Bowman St	House		1		---
59 Boynton St	House			1	---
19/21 C St	House		1		---
75/77 C St	House		1		---
116 Dartmouth St	House		1		---
81/83 Goffe St	House			1	---
106 Goffe St	House		1		---
87 Huntress St	House			1	---
105 Huntress St	House			1	---
16 Milford St (Getty Gas Station)	Commercial		1	1	---
98-102 Milford St	House		1		---
188 Milford St	House			1	---
30 Prince St	House		1		---
29 Sullivan St	House		1		---
24/32 Schuyler St	House		1		---
25 Schuyler St	House		1		---
45 Schuyler St	House		1		---
227 S. Main St (Walgreens)	Commercial			1	---
232 S. Main St (Martells)	Commercial			2	---
234 S. Main St	House		1		---
240 S. Main St	House		1		---
293 S. Main St	House		1		---
Mobil on S. Main St	Commercial		1	2	---
23 Tilton St	House			1	---
Kustom Kreations (5 Varney St)	Commercial		1		---
45/53 Varney St	House	1		1	---
65 Varney St	House			2	---
Bill's Auto (on Varney St)	Commercial		1		---
194 W. Hancock St	House			1	---
59/61 Wheelock St	House			1	---

Manchester, NH
Phase 1 CSO Summary Report
Identified Inflows and Suspected Illicit Inflow Connections (III)

Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
Lewis Street	Public			5	
CSO Separation Contract 004 - South Main (north), West Bridge & Victoria Sts					
12/14 Blucher St	House		1		---
146 Cartier St	House		1		---
150 Cartier St	House		1		---
159 Cartier St	House		1		---
218 Cartier St	House		1		---
72/74 Conant St	House		1		---
175 Conant St	House		1		---
239 Conant St	House		1		---
290 Conant St	House		1		---
Workman's Club	Commercial		1		---
159/161 Douglas St	House		1		---
183 Douglas St	House		1		---
286/288 Douglas St	House		1		---
316 Douglas St	House		1		---
107 Dubuque St	House		1		---
199 Dubuque St (97 Sullivan St)	House		1		---
353 Dubuque St	Apartments		1		---
377 Dubuque St	Apartments		1		---
227/229 Dubuque St	House		1		---
266 Dubuque St	House		1		---
567 Granite St	House		1		---
415 Granite St	House		1		---
33 Hecker St	House		1		---
39/45 Hecker St	House		1		---
241 Hevey St	House		1		---
219/221 Notre Dame Ave	House		1		---
147 Notre Dame Ave	House		1		---
157 Notre Dame Ave	House		1		---
217/221 Notre Dame Ave	House		1		---
244 Notre Dame Ave	House		1		---
316 Notre Dame Ave	House		1		---
330 Notre Dame Ave	House		1		---
394 Notre Dame Ave	House		1		---
396/398 Notre Dame Ave	House		1		---
70 Park Ave	House	1			---
53 Parker Ave	House		1		---
92/94 Parker Ave	House		1		---
10-14 Quincy St	House		1		---
329 Rimmon St	House		1		---
58/60 Rimmon St	House		1		---
330 Rimmon St	House		1		---
298 South Main St	House		1		---
76 Sullivan St	House		1		---
26 Walsh Ave	House		1		---

Manchester, NH
Phase 1 CSO Summary Report
Identified Inflows and Suspected Illicit Inflow Connections (III)

Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
133 Wayne St	House		1		---
176/178 Wayne St (343 Rimmon St)	House		1		---
336 Dubuque St (Durette Photo Lab)	Commercial		1		---
89/91 West St	House		1		---
53 West St	House		1		---
CSO Separation Contract 005 - West Bridge, Lorraine & Bremer Sts					
179 Alsace St	House	1		1	---
235 Alsace St	House	1			---
108 Alsace St	Apartments		1		---
156 Alsace St	Apartments		1		---
1 Amory St	Apartments		1		---
293 Amory St	House		1		---
301 Amory St	House		1		---
316 Amory St	House	1	1		---
325/327 Amory St (7/11 Reed St)	House		1		---
237 Amory St	Apartments		1		---
90 Bremer St (621 Hevey St)	House		1		---
59 Bremer St	Apartments		1		---
27/29 Bremer St	Apartments		1		---
J.N. Bouford & Sons (676 Montgomery St)	Commercial		1		---
456 Cartier St	Apartments		1		---
415 Cartier St	House		1		---
433 Cartier St	House	1	1		---
Catholic Medical Center	Hospital		1	3	---
360 Coolidge Ave	Apartments		1		---
598 Dubuque St	Apartments		1		---
99 Eddy Road	House		1		---
491 Hevey St	House		1		---
693 Hevey St	House	1	1		---
166 Hevey St	Apartments		1		---
511 Hevey St	Apartments		1		---
527 Hevey St	Apartments		1		---
593 Hevey St	Apartments		1		---
Boys/Girls Club (Kelley St)	Commercial		1		---
Citgo (321 Kelley St)	Commercial		1		---
332 Kelley St	Commercial		1		---
Osco Drug	Commercial		1		---
Sign Says (342 Kelley St)	Commercial		1		---
St Patrick Building (138 Coolidge Ave)	Commercial		1		---
358-362 Kelley St	House		1		---

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Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
St John Church (107 Alsace St)	Church	2	1		---
88 Main St	Apartments		1		---
Pariseau Apts (Montcalm St)	Apartments		1		---
779 Montgomery	House		1		---
657 Montgomery St	House	1			---
660 Montgomery St	House	1			---
692 Montgomery St	House	1			---
888 Montgomery St	House		1		---
645 Montgomery St	Apartments		1		---
434 Notre Dame Ave	House		1		---
442 Notre Dame Ave	House		1		---
76 Reed St	House		1		---
83 Reed St	House		1		---
194 Reed St	House	1			---
232 Reed St	House	1			---
377 Rimmon St	House		1		---
644 Rimmon St	Apartments		1		---
636 Rimmon St	Apartments		1		---
268/270 Rimmon St	Apartments		1		---
146 Wayne St	Apartments		1		---
85 Youville St	House	1			---
251 Youville St	House	1	1		---
501 Youville St	House	1			---
CSO Separation Contract - Poor & Schiller Sts					
Second St Businesses:					
Corvette City	Commercial		1		---
Second St Auto	Commercial		1		---
764 2nd St	Commercial		1		---
KFC	Commercial		1		---
Dunkin Donuts	Commercial		1		---
McDonald's	Commercial		1		---
Mallard Pond Plaza (#1-3)	Commercial		1		---
Midas Muffler	Commercial		1		---
Second St Plaza	Commercial		1		---
Clam King	Commercial		1		---
Second St Car Wash	Commercial		1		---
Wendy's	Commercial		1		---
D&L Auto	Commercial		1		---
Kerner's Car Wash	Commercial		1		---
636 2nd St	Commercial		1		---
Burger King	Commercial		1		---
77 Coburn St	House		1		---
66 Hillcrest Ave	House	1			---
49 Hillcrest Ave	House	1			---
44 Hillcrest Ave	House	1			---
11 Manning St	House	1	1		---

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Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
CSO Separation Contract 006 - Crescent & Third Sts					
378 Myrtle Street	House		1		---
Overland Street	Public CB			1	
Flat Roof Buildings Identified from Aerial Photography					
thwest Elementary School Youville St			1		
41 Upland St			1		
141 Lafayette Rd			1		
117 Lafayette Rd			1		
148 Laval St			1		
209 Joliette St			1		
111 Joliette St			1		
198 Alsace St			1		
180 Alsace St			1		
164 Alsace St			1		
122 Alsace St			1		
218 Bremer St			1		
200 Bremer St			1		
85 Youville St			1		
582 Hevey St			1		
578 Hevey St			1		
599 Hevey St			1		
533 Hevey St			1		
540 Rimmon St			1		
595 Dubuque St			1		
157 Eddy Rd			1		
100 Eddy Rd			1		
550 Cartier St			1		
516 Cartier St			1		
74 Moore St			1		
400 Kelley St			1		
358 Kelley St			1		
366 Kelley St			1		
150 Kelley St			1		
518 Rimmon St			1		
494 Cartier St			1		
300 Kelley St			1		
345 McGregor St			1		
80 Dionne Dr			1		
563 Amory St			1		
541 Amory St			1		
519 Amory St			1		
13 Laval St			1		
520 Montgomery St			1		
494 Cartier St			1		
474 Cartier St			1		
477 Cartier St			1		

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Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
473 Cartier St			1		
445 Cartier St			1		
429 Cartier St			1		
415 Cartier St			1		
440 Hevey St			1		
493 Montgomery St			1		
257 Amory St			1		
33 Congress St			1		
33 Kearsarge St			1		
526 Amory St			1		
396 Amory St			1		
374 Amory St			1		
496 Bartlett St			1		
66 Essex St			1		
466 Bartlett St			1		
454 Bartlett St			1		
270 Amory St			1		
408 Rimmon St			1		
407 Rimmon St			1		
393 Dubuque St			1		
102 Kearsarge St			1		
358 Bartlett St			1		
251 Putnam St			1		
322 Bartlett St			1		
355 Putnam St			1		
277 Sullivan St			1		
312 Rimmon St			1		
304 Rimmon St			1		
378 Notre Dame Ave			1		
122 McGregor St			1		
195 McGregor St			1		
95 McGregor St			1		
226 Bartlett St			1		
217 Bartlett St			1		
333 Allard Dr			1		
7 McGregor St			1		
311 Main St			1		
101 Dubuque St			1		
302 Main St			1		
280 Main St			1		
101 Allard Dr			1		
26 Sullivan St			1		
137 Cartier St			1		
9 Blucher St			1		
320 Douglas St			1		
172 Douglas St			1		
105 Douglas St			1		
93 Douglas St			1		

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Identified Inflows and Suspected Illicit Inflow Connections (III)

Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
79 Douglas St			1		
32 Main St			1		
4 Main St			1		
49 Main St			1		
96 Douglas St			1		
78 Douglas St			1		
21 Main St			1		
482 Granite St			1		
55 S Main St			1		
63 S Main St			1		
20 S Main St			1		
340 Granite St			1		
314 Granite St			1		
300 Granite St			1		
290 Granite St			1		
77 School St			1		
55 School St			1		
26 School St			1		
36 School St			1		
66 School St			1		
15 Third St			1		
106 School St			1		
21 Third St			1		
72 Second St			1		
82 Second St			1		
32 Bath St			1		
89 Second St			1		
93 Second St			1		
17 Ferry St			1		
104 S Main St			1		
128 S Main St			1		
140 Second St			1		
191 Turner St			1		
146 Second St			1		
178 Second St			1		
180 Second St			1		
179 Blaine St			1		
111 Blaine St			1		
223 Blaine St			1		
226 Blaine St			1		
45 Blaine St			1		
152 S Main St			1		
224 Cleveland St			1		
200 Cleveland St			1		
150 Blaine St			1		
140 Blaine St			1		
170 Cleveland St			1		
165 Third St			1		

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Address	Location Description	Type of Inflow Identified			Records on-hand to Complete Removal?
		Sump Pump	Roof Drain	Yard Drain	
20 Blaine St			1		
63 Cleveland St			1		
32 Cleveland St			1		
79 Wilkins St			1		
5 Kingston St			1		
323 Varney St			1		
66 Carroll St			1		
169 S Main St			1		
168 S Main St			1		
227 S Main St			1		
222 S Main St			1		
133 W Hancock St			1		
130 W Hancock St			1		
75 W Hancock St			1		
420 Second St			1		
425 Second St			1		
447 Second St			1		
467 Second St			1		
475 Second St			1		
188 Dartmouth St			1		
311 Queen City Ave			1		
298 Queen City Ave			1		
526 Second St			1		
581 Second St			1		
200 Woodbury St #316			1		
468 S Main St			1		
488 S Main St			1		
525 S Main St			1		
140 Harvell St			1		
1050 Second St			1		
1019 Second St			1		
1017 Second St			1		
900 Second St			1		
91 Poor St			1		
	Totals:	**28**	**204**	**57**	